MODERN PLASTICS

DECEMBER 1959

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Report from Duesseldorf *p. 153*

New jobs for the specialty phenolics *p. 81*

The blow molding market—and you *p. 96*

Latest on chill-roll casting *p. 109*

PRODUCT-DESIGN BRIEFS FROM DUREZ

- **Fire-safe umbrella roof**
- **Plastic for toughest electrical jobs**
- **Where to get ideas**

Speaking of Stability

This is one piece of a small roomful of high-class electronic hardware.

The hardware represents man's latest and most sophisticated effort to cram into 123 square feet of floor space the means of discovering in one day which of 15,000 small semiconductors will work in a given set of circumstances, and which ones won't.

STROMBERG-CARLSON

This piece carries the semiconductor through the test gantlet. Around and around it goes, over six electrical-test hurdles, through an oven at a blistering 200°C, and back again for another trip.

Few materials have what it takes to survive this merry-go-round with virtually no change in size, shape, strength, toughness, and insulation values. Here you see one that does–a Durez diallyl phthalate molding compound filled with glass roving.

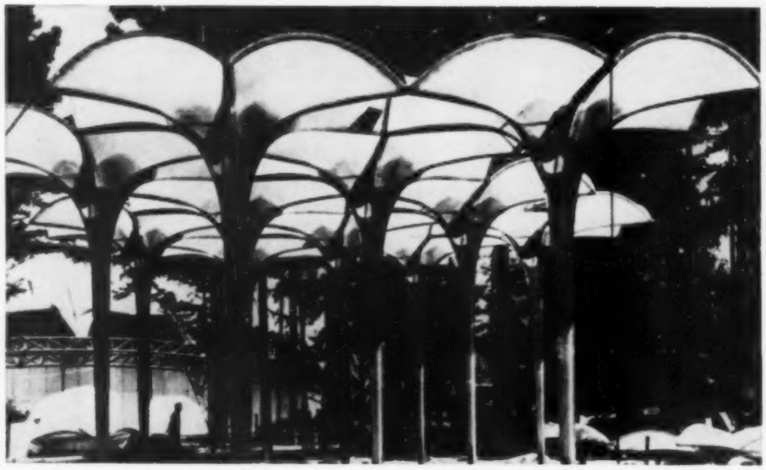
This is just one of the family. As a class, Durez diallyl phthalate compounds offer unsurpassed freedom from cold flow and creep, high reproducible arc resistance, a chilly indifference to moisture.

You get more information on them by talking over the intended application with your molder. He can describe them far more glowingly than do our data sheets, which we'll gladly send you.

Symbol

When promoters of the American National Exhibition in Moscow displayed a cross-section of America in old Sokolniki Park under flaring umbrellas of glass fiber and Hetron,® they built even better than they knew.

For the tapering 16-foot columns arching into 15,000 square feet of fire-resistant roof, architect George Nelson used our Hetron polyester. One of the



OWENS-CORNING FIBERGLAS CORP.

reasons: Hetron does not support combustion; it requires no additives, as do other polyesters, to make it resist fire.

Another reason: strength. Structural engineers learned that winds in Moscow sometimes reach 60 mph. So they tested five of the lily-like umbrellas at Mitchell Field, N. Y., by blasting them with 60-plus-mph gusts from the twin propellers of an Air Force bomber.

The payoff: a coup for the U. S. when a sudden Moscow storm caused aluminum arches to buckle badly in the sparsely attended Soviet exhibition next door. In the jam-packed U. S. showcase, Hetron stood fast.

Idea Starter

That's the virtue of our modest little bimonthly bulletin, *Durez Plastics News*. It starts ideas.

It discusses products, from closures to computers, from plastic portholes to potentiometers. It shows you how Durez plastics are used.

Though its scope is the whole world of products and product design, you can read it through in 10 minutes. Thousands of people tell us it helps them keep up to date, in an age when keeping up to date can be a full-time job.

We'd like to send *Durez Plastics News* to you. May we? If you'd like to receive it regularly, just check the coupon.

For more information on Durez materials and services mentioned above, check here:

- ☐ Data file on Hetron, including list of fabricators
- ☐ Diallyl phthalate molding compounds (data sheets)
- ☐ *Durez Plastics News* (bimonthly bulletin)

Clip and mail to us with your name, title, company address. (*When requesting samples, please use business letterhead.*)

DUREZ PLASTICS DIVISION

1212 WALCK ROAD, NORTH TONAWANDA, N. Y.

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MODERN

*

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PLASTICS*

DECEMBER 1959
Volume 37 Number 4

• ENGINEERING

• TECHNICAL

• DEPARTMENTS

Coming Up . . .

Our 1960 cover series, by famed photographers Ray Cicero, Rudy Muller and Alan Fontaine, promises to be the most exciting we have yet used . . . Theme is "Plastics in the Product Revolution," and purpose is to show how plastics have made possible improved designs with greater utility and better values in telephones, cameras, appliances, fishing tackle, tableware, furniture, radios, and a long list of other products . . . Statistical information for our January Annual Review and Forecast Issue is now being gathered . . . What a year! January will include a review of significant applications and processing developments in 1959, plus our usual Engineering and Technical Reviews with literature references . . . Also the score on plastics processing machinery sales . . . And a significant summary of industry leaders' opinions on plastics markets for the next five years. Finally, a complete price history of all plastics resins . . . emphasis in February issue will be on Reinforced Plastics.

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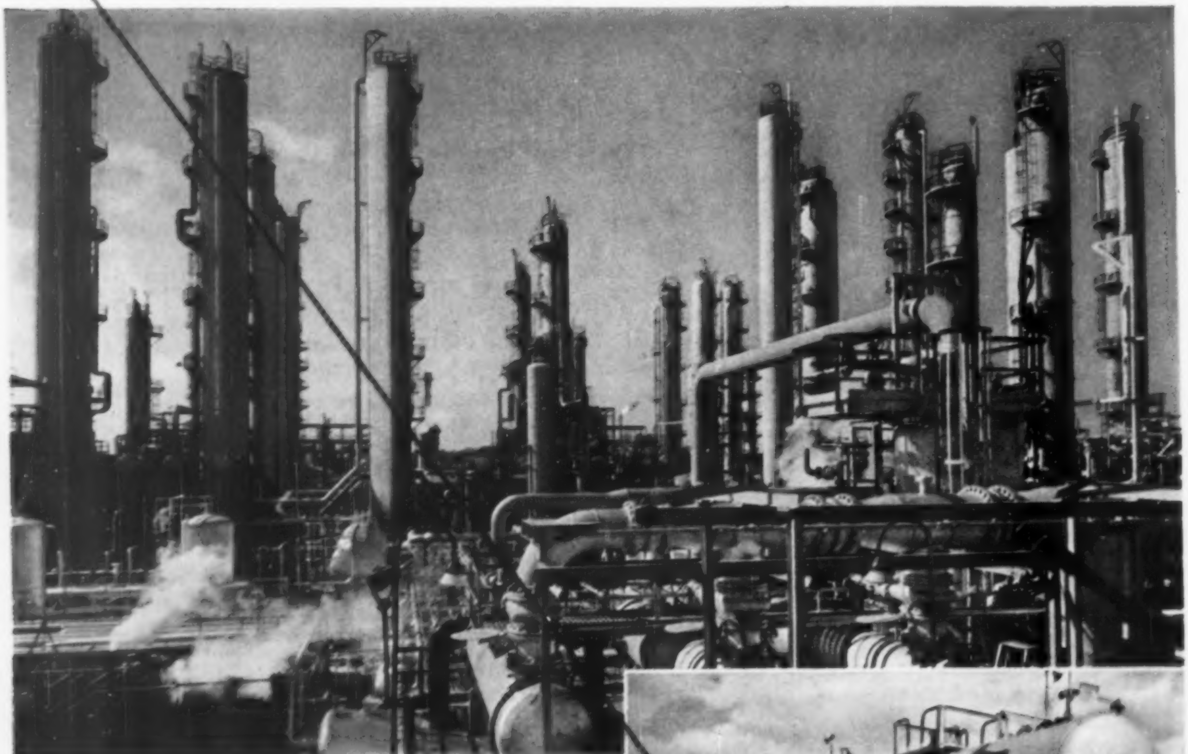
second successful year of substantial commercial output

n-BUTENE-1 (95% minimum)



Anticipating increased interest in copolymers of n-BUTENE-1 and other olefins, Petro-tex came on stream with 95% minimum n-BUTENE-1 a year ago. Now, this high-purity alpha olefin is being used by important producers of linear olefinic polymers to improve resistance to stress cracking and to reduce low-temperature brittleness.

Highly-reactive Petro-tex n-BUTENE-1 also undergoes a wide range of oxidation, hydration, alkalation and oxo-process reactions with interesting petrochemical possibilities.

We invite inquires for technical data, specifications, price and delivery quotations on n-BUTENE-1, as well as . . .

n-BUTENE-2 (95% minimum) **ISOBUTYLENE** (99 + % pure)

BUTADIENE **DIISOBUTYLENE** **TRIISOBUTYLENE**

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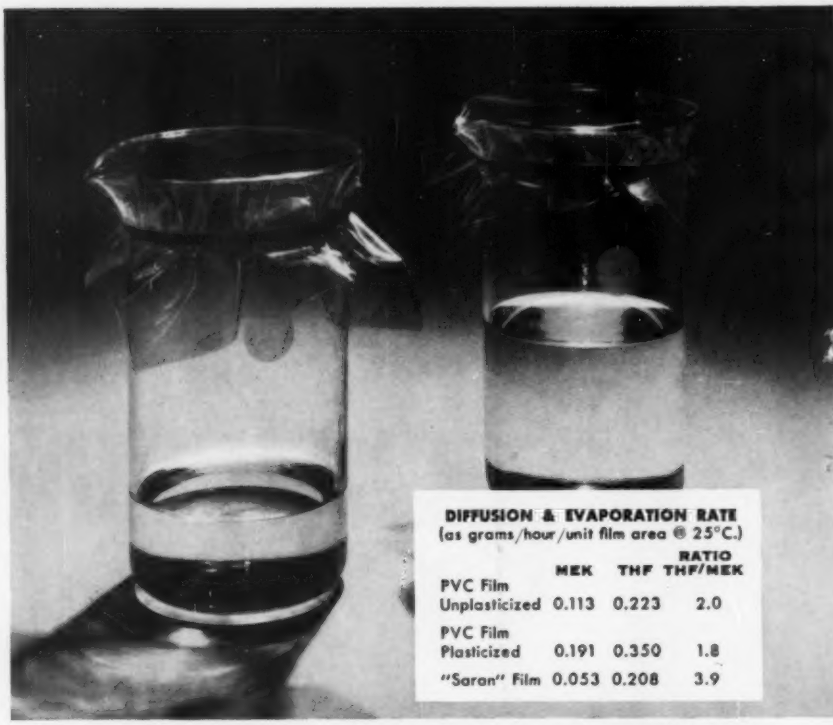
FILM CASTERS,
ADHESIVE
MANUFACTURERS
CAN...



DIFFUSION & EVAPORATION RATE
(as grams/hour/unit film area @ 25°C.)

	MEK	THF	RATIO THF/MEK
PVC Film Unplasticized	0.113	0.223	2.0
PVC Film Plasticized	0.191	0.350	1.8
"Saran" Film	0.053	0.208	3.9

The two containers above were filled with equal volumes of THF (left) and methyl ethyl ketone (right). Each was covered with a PVC film and allowed to stand for an equal period. Results show THF diffuses through and evaporates from PVC films about twice as fast as MEK.

Save money, improve with Du Pont

THF HAS HIGH SOLVENT POWER

Even the highest molecular weight polyvinyl chloride resins dissolve readily at room temperature in Du Pont tetrahydrofuran—resins that are practically insoluble in other industrial solvents. High solids solutions at workable viscosities can be prepared, enabling users to take full advantage of the superior properties offered by such resins.

RESULT: *More durable vinyl coatings and films with improved resistance to abrasion, soil and chemical attack. Better adhesive formulations to promote higher bond strengths.*

THF HAS FAST DIFFUSION & EVAPORATION RATES

Du Pont tetrahydrofuran diffuses and evaporates more rapidly than a wide range of other commonly used resin solvents ... up to 2 times as fast as ketone solvents (see above). Drying cycles are reduced, as are problems with residual solvent in coatings and films.

RESULT: *Coating and film casting machines can be run up to 2 times faster—you can produce the same work in half the time. Quality is improved, no tacky surfaces. Adhesives set much quicker.*

Du Pont tetrahydrofuran is available in 55-gallon drums, tank-wagon, and tank-car quantities. Orders may be placed with Du Pont's nearest Electrochemicals Department District Office.

DISTRICT OFFICES

Baltimore 2, Md. .... 321 Fallsway
Boston, Mass. .... 45 Fourth Ave., Waltham 54, Mass.
Charlotte 1, N. C. .... 427 W. Fourth St.
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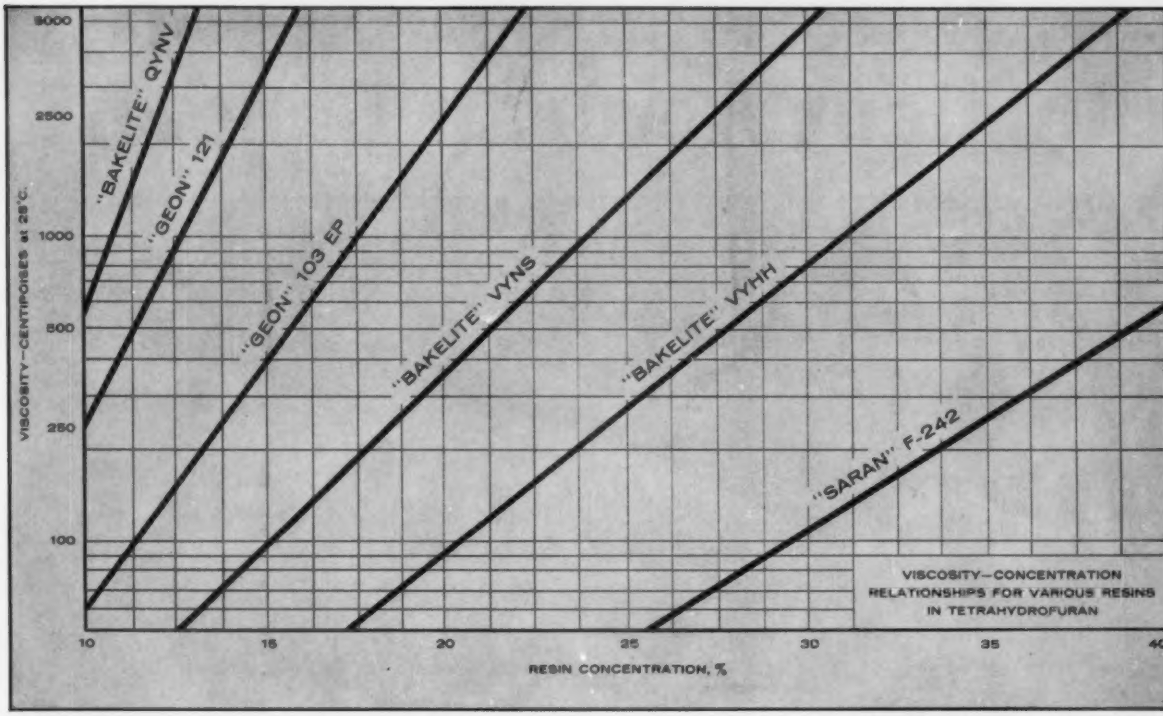

THF dissolves more PVC resin at room temperature than other solvents: The chart above shows the high percentage of various PVC resins which can be dissolved in tetrahydrofuran.

"Bakelite"—TM Union Carbide & Carbon Corp.
"Geon"—TM B. F. Goodrich Chem. Co.

vinyl product quality Tetrahydrofuran (THF)

THF IS EASILY RECOVERED

Up to 95% of tetrahydrofuran throughput can be recovered from coating, printing and film casting operations. Standard carbon adsorption units constructed of ordinary steel can be used to recover THF, whereas stainless steel equipment is necessary for recovery of many other solvents.

RESULT: *You are assured of minimum solvent loss—low recovery cost. Most existing systems can be modified easily and economically to recover THF.*

THF PROPERTIES

Appearance	Colorless, mobile liquid
Odor	Etherlike
Molecular weight	72.10
Freezing point	-108.52°C.
Boiling range	65°-67°C.
Specific gravity (20°/4°C.)	0.888
Weight, lb./gal. (20°C.)	7.4
Flash point (Tag closed cup)	6°F.

Vapor pressure, mm Hg. at:

15°C	114	45°C	385
25°C	176	55°C	550
35°C	263	65°C	760

Surface tension, dynes/cm. (25°C.) 26.4

Solubility. . Miscible with water, soluble in most organic solvents

Use THF to get greater savings and improved quality for all your vinyl products whether they be coatings, films or adhesives. We'll be glad to work with you in developing your particular application for this remarkable solvent. For more information on THF, just drop a line to Du Pont at the address below:

E. I. DU PONT DE NEMOURS & CO. (INC.)
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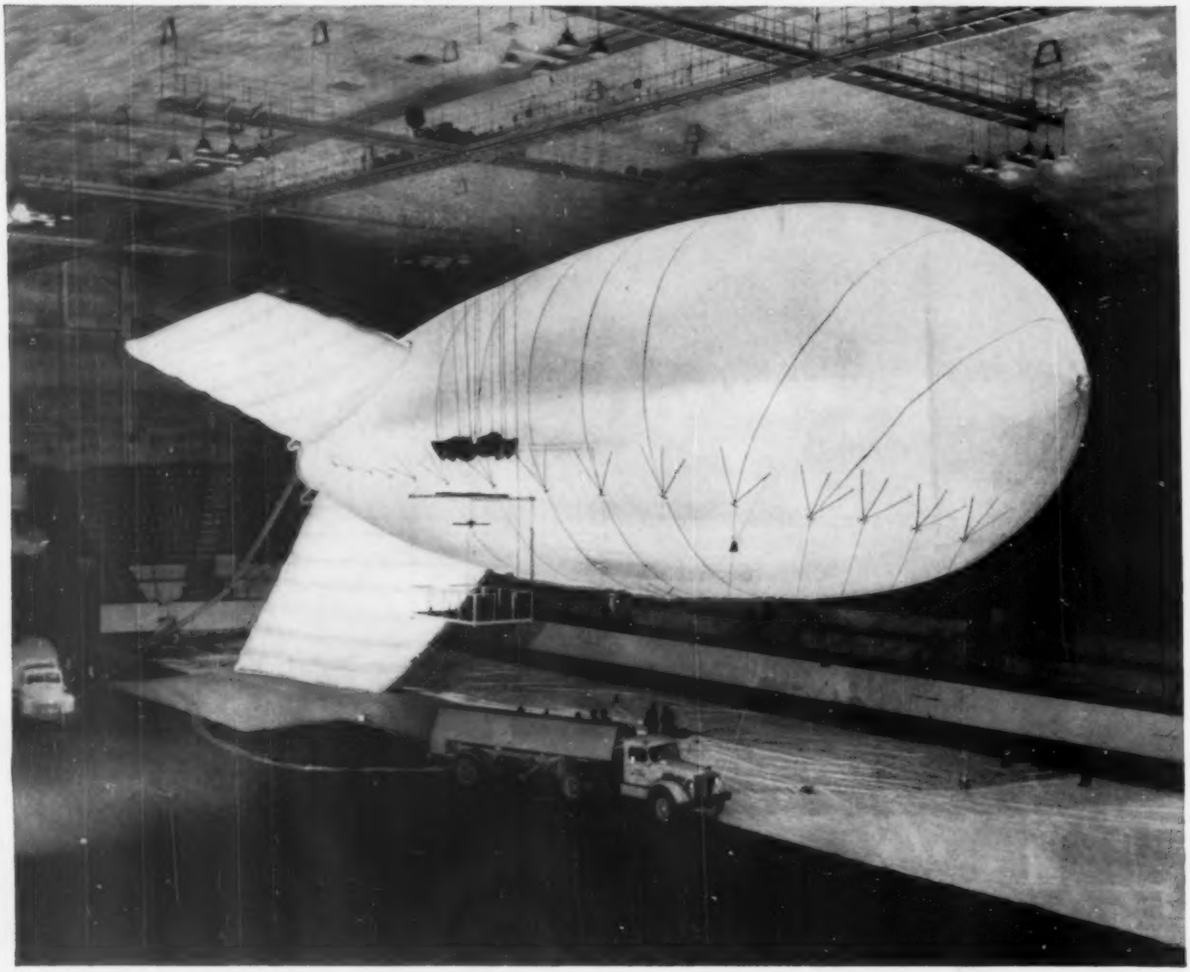
Fabric takes to the air in giant Aerocap Balloon



Recently developed by the Mechanical Division of General Mills, a huge balloon made of impregnated fabric now provides a practical means for establishing captive aerial platforms for scientific equipment. Designed for stability and durability under adverse weather conditions, these amazing Aerocaps–the largest of which can lift up to 15,000 pounds–have been used in atomic weapons testing and in elevating radar antennas, acoustical measuring devices and other scientific instrumentation.

The fabric that meets the rugged requirements of this revolutionary development is Wellington Sears nylon, one of many base fabrics engineered for specific jobs of all kinds . . . for laminating, coating and rubberizing.

Wellington Sears has been supplying fabrics to industry for more than a century. Why not take advantage of this experience for help in your own fabric applications. Write today for your copy of a free illustrated booklet, "Fabrics Plus." Address Dept. K-12.

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U.S.I. POLYETHYLENE NEWS

A series for plastics and packaging executives by the makers of PETROTHENE® polyethylene resins

DECEMBER, 1959 U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation 99 Park Ave., N. Y. 16, N. Y.

Packaging Notes

A handy polyethylene pump for inflatable items has been marketed by a California manufacturer of air matresses and beach toys.

The pump consists of an open polyethylene bag with a reinforced hole at one lower corner. The polyethylene pump is used by attaching it to the valve of the inflatable item, and fluffing the bag open. Then the top is closed by rolling it. Finally, the bag is squeezed down and rolled to force the air from it into the inflatable item.

Compact First Aid Kits of Polyethylene are being marketed. The inexpensive kits are specially designed for marine use, but outlast metal containers any place where corrosion is a problem. The kits are water, rust, and mildew proof. They also float. The kits are available in two sizes and contain bandages, tapes, ointments, and scissors normally found in first aid kits.

Wholesale jewelers use polyethylene bags to ship their merchandise. The tough polyethylene bags not only give better inspection advantages but they also eliminate heavy returns of jewelry formerly scratched in shipping.

Use of a heat-sealed strip of polyethylene has greatly reduced the difficulty of opening sealed polyethylene bags. This application of polyethylene is now being used by a cake mix producer for easy opening of his package's inner bag.

A ½ inch strip of polyethylene is welded along the width of one side of the bag by a thin line of heat-sealing. It runs 1 inch below the top of the bag and extends ¼ inch from each edge of the bag. When the free end of the strip is pulled, the polyethylene bag tears with it along the heat-seal line.

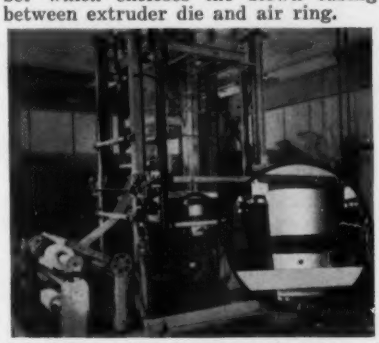
DO YOU HAVE a new polyethylene packaging development you'd like the industry to know about? Make it routine to send your information on new developments to U.S.I. POLYETHYLENE NEWS.

Address the Editor,
U.S.I. POLYETHYLENE NEWS, U. S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp., 99 Park Avenue, New York 16, N.Y.

New U.S.I. Technique Improves Optical Properties of Blown Polyethylene Tubing

Annealing Chamber Increases Light Transmittance, Reduces Haze

The U.S.I. Polymer Service Laboratory has developed an annealing chamber or "chimney" technique which results in significant improvement in clarity and gloss of blown polyethylene tubing, with practically no sacrifice of physical strength. The method, involves installation of a chamber which encloses the blown tubing between extruder die and air ring.



Polyethylene tubing has improved clarity and gloss when produced with new U.S.I. annealing chamber technique. Close-up view shows "chimney" in place between extruder and air ring.

Unit is easy to install

The chimney may be made of wood, glass or insulated metal. It should be constructed in two sections or hinged to permit installation during extrusion . . . thus eliminating need for rupturing the "bubble" when threading film through the annealing chamber.

Height of chimney is an important factor. Optimum results are usually obtained with a 6 to 10" chimney height. While ratio of chimney diameter to die diameter is not critical, it should be held between 2:1 and 3:1. For example: a 3" die would require a 6 to 9" chimney diameter.

An evaluation of PETROTHENE P-200-25 resin using this technique revealed:

Optical Property	*No Chimney*	*8" Chimney*
Transmittance	30%	70%
Gloss	7%	11%
Haze	11%	4%

No significant change was noted in impact strength. Elmendorf tear tests showed that a directional strength balance was brought about by adding the chimney. Tear values increased in the transverse direction and decreased in the machine direction. Yield, break and elongation were essentially unchanged.

Work on this new technique is continuing at the U.S.I. Polymer Service Laboratory, where your inquiries are always welcomed. If you have special problems, U.S.I. engineers will gladly offer their assistance. You are also invited to write for a Technical Data Sheet describing the new process.

Polyethylene "Socks" Used in Causeway Construction

A causeway between Miami and Miami Beach will consist of a number of bridges connecting a series of man-made bulkheaded sand islands. The company building the causeway has found a unique construction use for polyethylene film "socks."

When the sheetpiles that form the bulkheads for the man-made islands are in place, the top pockets or slots between adjacent piles are grouted with mortar to make the wall absolutely tight and prevent loss of sand fill. To prevent leakage of mortar in this operation and to save time in building forms, the contractor devised polyethylene "socks" that fit in the slots to be filled.

A small amount of mortar is placed in the bottom of the "sock." The sock or bag is then allowed to sink into place in the slot and the rest of the mortar is then poured into it. The method is described as an efficient and effective way to seal joints in precast concrete structures, whether in water or in the dry.

Polyethylene is Vacuum Formed on Planting Pots

A midwest company has developed a process for vacuum forming 1 mil polyethylene film around peat moss planting pots.

The pots, which are used to start flowers, vegetables and nursery stock of all types, shorten the plants' growing period, and at the same time, improve their quality.

Photo courtesy
A. O. Reynolds Co.,
Lebanon, Indiana

This vacuum forming of polyethylene has significantly improved the pots' strength by increasing their resistance to water damage. The polyethylene jacket insures a constant supply of water for the plant in the pot. When the plant and its pot are ready to be put in the ground, the polyethylene film strips off easily.

These pots, now being field tested extensively by greenhouses and commercial growers, are molded by drying peat moss paper slurry. The polyethylene film is then vacuum-mated to them.

U.S.I. POLYETHYLENE PROCESSING TIPS

Vol. IV, No. 6

PROPERTIES THAT AFFECT GREASEPROOFNESS OF POLYETHYLENE COATINGS

As used in the paper coating industry, the term greaseproofness generally refers to conformity of a polyethylene coating with Military Specification MIL-B-121A. This specification defines the grease resistance of polyethylene-coated paper used to package material which is grease-coated for long-term storage.

Under this specification, greaseproofness is tested by measuring the resistance of polyethylene-coated paper to a turpentine solution of a dyed grease. Test conditions require 24 hours exposure to the solution at a specified temperature and relative humidity. To meet the specification, all samples tested must be free of dye color on the uncoated side of the paper at the conclusion of the test period.

Although this specification was drawn up to satisfy the stringent requirements of military applications, it is also employed to define the grease resistance of polyethylene-coated paper to be used for industrial and food applications. However, there are many cases where the requirements of MIL-B-121A may be reduced and still be entirely satisfactory. How far these requirements may be lowered can best be determined through actual tests with the item to be packaged.

Importance of Resin Density and Melt Index

One resin property having an important effect on the greaseproofness of a coating is density. Generally, as resin density is increased from 0.915 to 0.930 and higher, the grease resistance of a polyethylene coating of a given weight improves considerably, as shown graphically in Chart 1. Polyethylene permeability to gases and liquids is similarly affected by density, as previously discussed in this series (U.S.I. Polyethylene Processing Tips, Vol. II, No. 2, and Vol. IV, No. 3). This is to be expected since greaseproofness is one aspect of permeability.

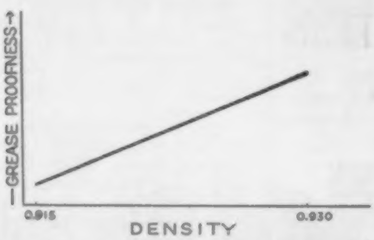


CHART 1

Melt index also influences greaseproofness, decreasing melt index resulting in improved grease resistance. However, melt index has less of an effect than density. Chart 2 shows this relationship.

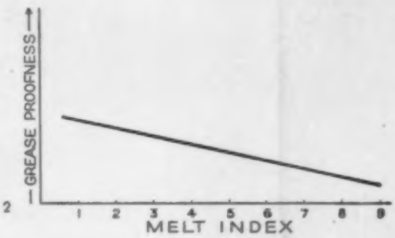


CHART 2

Balancing of Effects

But the paper coater seeking to produce grease-resistant polyethylene coatings cannot consider the effects of density and melt index on grease permeability alone. He must also consider the influence of these properties on the economical operation of his equipment. Such problems as increasing neck-in and curl resulting from the use of higher-density resins must be evaluated before selecting a resin for a given application.

Influence of Coating Weight

Greaseproofness of the finished sheet also depends on the weight of the polyethylene coating applied to the substrate. The greater the coating weight or thickness, the better the grease resistance. With a thicker coating or a resin of higher density, the likelihood of individual paper fibers fracturing the film surface during coating is reduced. With very heavy coatings, however, curl is increased and slower speeds are required.

What Type of Coating?

Theoretically, a heavy enough coating of any polyethylene resin will produce a sheet which will pass MIL-B-121A. But from a practical standpoint, the lowest coating weight which gives the most coverage per pound of polyethylene is an obvious ideal. This can be accomplished by selecting the highest-density resin which has good processibility, acceptable adhesion, and reasonable neck-in, and permits high operating speeds.

Economical coatings meeting MIL-B-121A requirements can be produced with PETROTHENE® coating-series resins. These resins usually yield a proper balance of properties wherever greaseproofness is the primary objective. Where other objectives are predominant, U.S.I. Technical Service Engineers will be glad to recommend the proper resin for your application. They'll also work with you on any processing problems you have.

Why Gilbert Plastics Uses Reed-Prentice Injection Machines Exclusively...

"Reed-Prentice gives us top performance and dependability," says Mr. Peter Preuss, Vice President of Gilbert Plastics in Kenilworth, New Jersey. "These REED presses help us get the jump on competition and have helped make Gilbert the largest manufacturer of tomato boats and berry baskets in the country. We've found through experience that Reed-Prentice machines can be counted on to deliver the high quality products we insist on here at Gilbert. REED machines have done more than their share toward building our reputation and growth."

Reed-Prentice injection machines can do the same rugged, dependable job for any molder who wants better, faster molding. REED engineering brings you the most advanced features in injection molding . . . machines designed for today's need with the capacity to handle future requirements as well. For example in the full REED line, you'll find these exclusive features:

Low pressure die closing mechanism assures complete protection in automatic molding.
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Centralized controls put all controls at operator's fingertips.
Adjustable stroke offers greater flexibility, increases injection capacity.

For complete information and specifications on the full REED line of injection molding machines, call your nearest REED Sales Engineer today.

Above, one of the REED machines running the tomato boat on automatic operation. Below, is the finished product over-wrapped and ready for market.

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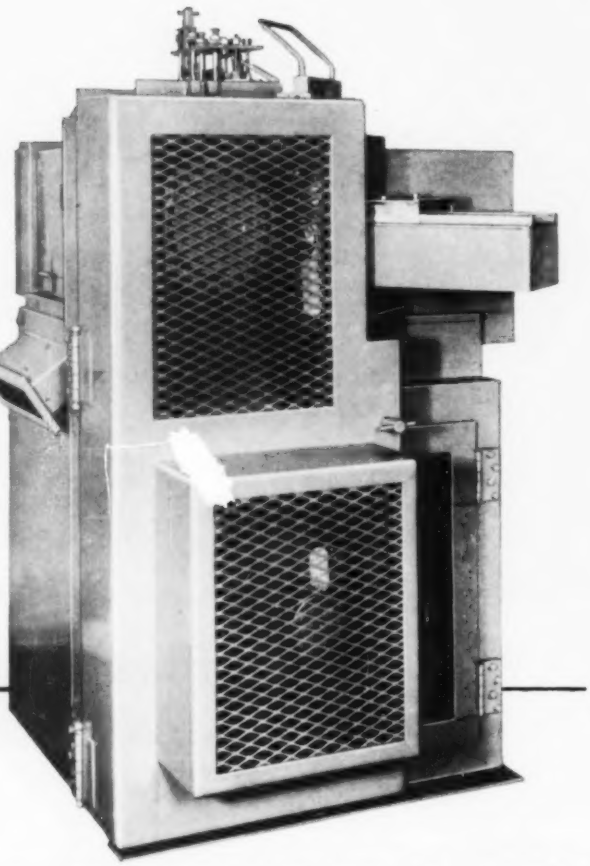

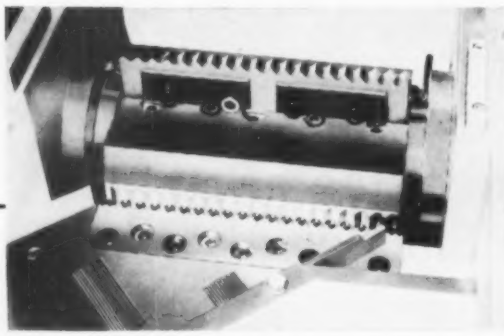

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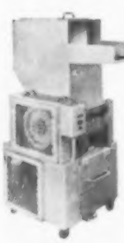

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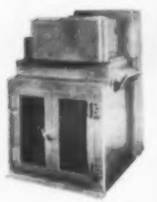

CUMBERLAND PELLETIZING MACHINE

New feed roll mechanism provides better control of extruded strands of plastic materials. Cuts cubes or pellets 1/32" to 1/2". 14" and 24" openings.

PERFECT RESULTS Exclusive 45° feed produces perfect cubes or rectangle pellets in sizes 1/16" to 1" in one severing operation — rotor knives cutting against one stationary knife.

VERSATILITY Dices wide range of extruded or milled thermoplastic ribbon, or sheet stock. TWO standard sizes to accommodate 7" or 14" stock. Special sizes built to order.

QUALITY CONSTRUCTION Ruggedly built. All surfaces contacting plastics materials are of corrosion resistant metals, stainless steel or chromium plated.

Watch for future ads featuring other outstanding Cumberland machines, and write for Bulletin 590.

Cumberland
ENGINEERING COMPANY, INC.

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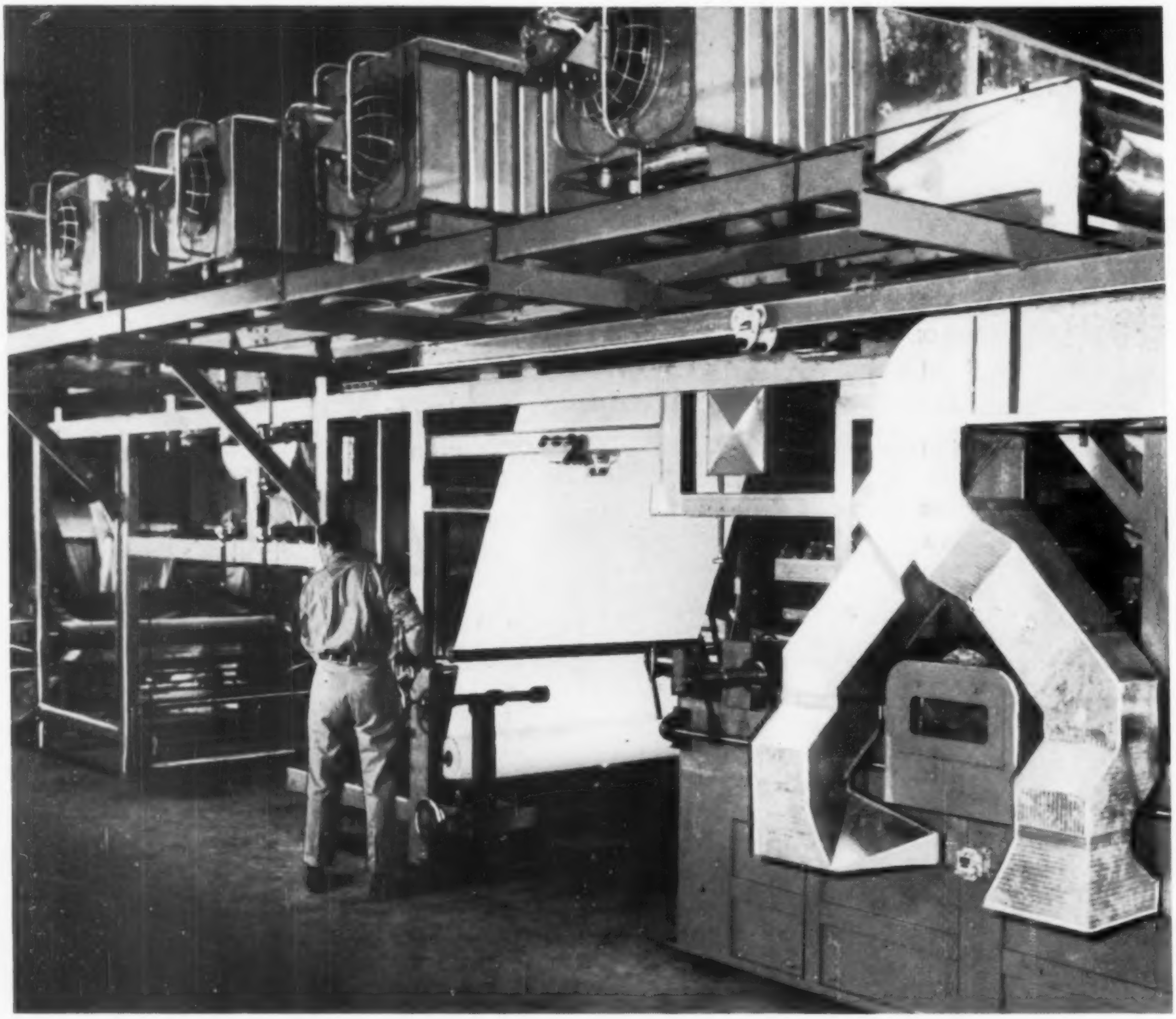

1-2 and the job is through!

This is the **LEMBO TOP COATING MACHINE** shown here turning out beautiful, super-durable upholstery for America's automobile manufacturers. The flawless, high speed operation **color coats** at the number-one station and **top coats** at number-two. Costs of processing unsupported or supported films are reduced thanks to Lembo time and labor-saving features like these . . .

- Heat and air circulation maintained between impressions.
- High temperature oven sets coatings.
- Tachometers at all critical work stations for stress-saving mechanical coordination.
- Equipped with choice of selective power or conventional drives.
- Available with hydraulic printing nip pressures to permit simultaneous backing away of all nips.
- Indexing units allow printing of narrower width film with simple indexing of impression roller.
- New variable tension controller and aluminum slat expanders, also available as optional equipment.

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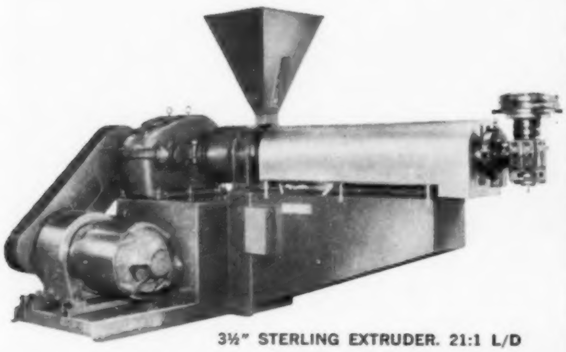
There is only one Lembo Machine! Be cautious of "Lembo-type" imitations.

STERLING

The Sterling Extruder is the product of sound engineering principles. But more than that it is a product that only long experience in the plastic industry could have made possible. These two factors are the key to Sterling's superior performance on the floor. Sterlings are available in sizes of 1½", 2", 2½", 3½", 4½" and 6" with L/D ratios of 15:1, 21:1, 24:1 or 30:1. Also available are completely packaged units and installations for the production of tubing, film, sheeting, rods and shapes, and for compounding, coloring and laminating from a complete range of thermoplastic materials. For complete details, write today directly to Mr. L. D. Yokana, President, Sterling Extruder Corporation, 1112 Baltimore Avenue, Linden, New Jersey. WAbash 5-3908.

PERFORMANCE



3½" STERLING EXTRUDER. 21:1 L/D

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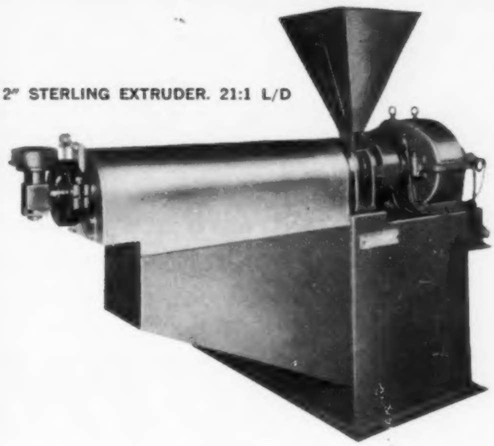
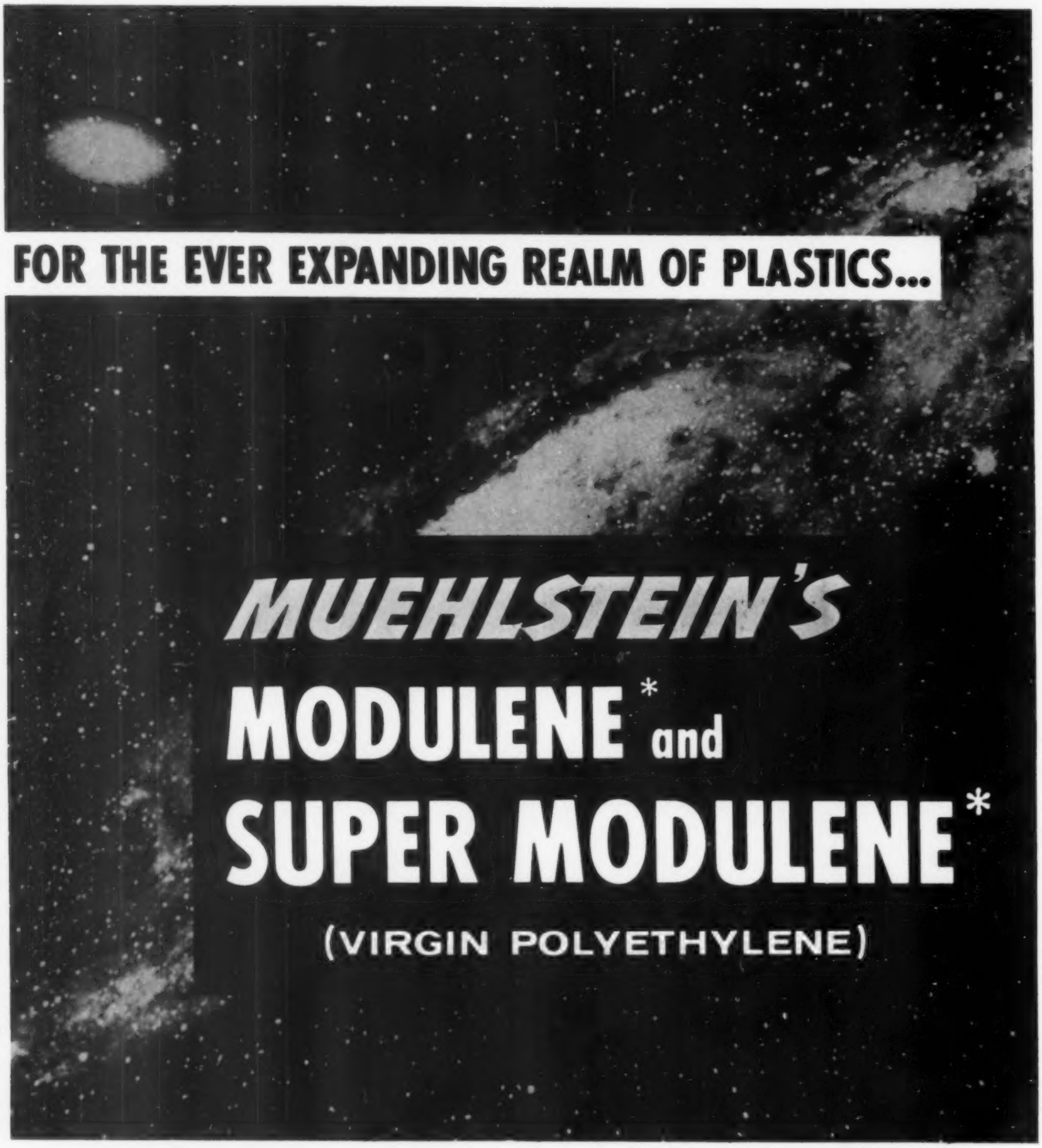
2½" STERLING EXTRUDER. 21:1 L/D

2" STERLING EXTRUDER. 21:1 L/D



STERLING EXTRUDERS – *"Designed by plastics men for plastics men"*



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SPECIFICATIONS

Machine Model	200-P-28	350-P-28
Material Injected Per Cycle (oz. max.)	28	28
Clamp Tonnage	200	350
Plasticizing Capacity (lbs./hr.)	90	150
Mold Space (in. max.)	15 x 26	20 x 34
Daylight (in.)	25	34
Daylight With Ejector Box Removed (in.)	29	42
Mold Thickness (min. Without Spacer-in.)	10	12
Stroke (in.)	15	22
Rate of Injection (cu. in./min.)	1320	1210
Horsepower	50	60

FOR MOLDERS WHO TACKLE THE TOUGH JOBS!

With H-P-M's New 28 Oz. Preplasticizers, Results Have Been Amazing

Concerned about tough molding jobs? Take a look at these new HPMs. Critical field tests, laboratory die try-outs, every trial to date has resulted in enthusiastic acceptance of these machines. Using polyproplyene, acrylic and many other thermoplastic materials, results have been outstanding. One molder said, "This type of machine opens a new era in molding tough jobs." They're extremely fast and have plenty of plasticizing capacity for molding on minimum cycles. Their high rate of injection, plus more than ample clamp tonnage assures more, and better quality, parts. With accurate shot control every part weighs the same. Yes, these new H-P-Ms really have what it takes. It will pay you to see them before you buy. Send, today, for complete information.

HPM

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- boats
- aircraft

Core Materials
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Encapsulation

Write for complete information.

Now, at the same cost as ordinary polyether prepolymers, Pelron brings you Resin #9665—a resin from which you can make rigid foams that are fully self-extinguishing or even totally non-burning!

Polyether #9665 requires no additives to give it its unique freedom from fire hazard. It is self-extinguishing because of its internal molecular nature. And, it is as easy to use as any regular polyether prepolymer, demanding no stirring as is the case with polyethers depending on various additives for self-extinguishing characteristics.

Flame impingement merely causes charring — with a complete absence of dangerously dripping, sputtering hot materials.

Suitable for both free-foaming and molded applications, #9665 can be controlled to yield foams ranging from 1.8 lbs./cu. ft. upwards.

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Foster Grant is *one* leading plastics producer that has never lost the ability to understand molders' problems. This is because Foster Grant entered the plastics business in 1919 both as a raw material customer and as a manufacturer of end products.

Through the years, Foster Grant has been successful at merchandising, mold design and machine building. In fact, in 1931, it was Foster Grant who introduced the first successful injection molding machine to America.

In the plastics industry, Foster Grant alone offers a quality line of resins "production tested" in its own molding facilities – many of them pioneered by its own engineers.

The value of this lifetime of successful, first-hand plastics experience is yours to draw on when you mold with Foster Grant resins.

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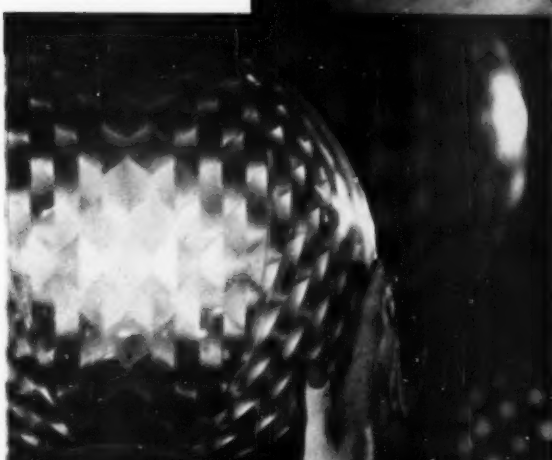
Looking for vinyl resins with "plus" properties?
Look to PLIOVIC by **GOODYEAR**

WANT TO IMPROVE THE AUDIO OF STEREO?

Pliovic has proved its ability to strengthen stereo record grooves and enhance tonal quality. It also improves compound "flow" during high-speed processing, reduces flash, makes possible more efficient production. Can it do the same for you?

NEED A CLEARLY SUPERIOR COMPOUND?

Pliovic is used in many applications where exceptional clarity and maximum flow at moderate temperatures are required—as in the molding of goggle frames. Ideal for calendered or extruded applications which call for critical processing and excellent transparency.

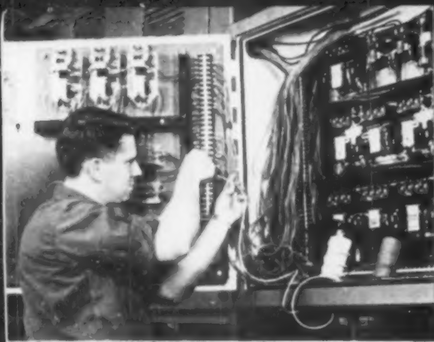


Photos courtesy the following companies: Capitol Records, Inc., Hollywood, Calif., Harte & Co., Inc., New York, N.Y., and American Optical Company, Southbridge, Mass.

HOW ABOUT A FILM IN 3-D?

Careful compounding and processing of fluorescent pigments with Pliovic produced this strikingly different beach ball made of vinyl film. Pliovic processes readily at relatively low temperatures, minimizes the effects of heat degradation on both resin and pigment, embosses easily and sharply—and provides excellent heat-sealability.

For more sales-building ideas with Pliovic—turn the page—




More resins in the Pliovic family with

more "plus" values for you

PLIOVIC S50 – a low molecular weight straight PVC resin with the inherent toughness of PVC resins but with flow characteristics comparable to the copolymers. Now being used in stereo record compounds.

PLIOVIC S70 – a general purpose, medium viscosity PVC resin. Well suited for applications requiring maximum flow, sparkling clarity and moderate processing temperatures.

PLIOVIC AO–a copolymer PVC dispersion resin, available in three paste viscosity grades. In plastisol formulations, it offers gradual gel properties that begin at relatively low mold temperature.

PLIOVIC DB90V – a high molecular weight PVC dry blending resin. Provides free-flowing dry blends, uniform fluxing rate and smooth, homogeneous vinyl products.

PLIOVIC DB80V – offers the same quality features as DB90V, but has lower molecular weight. Can be fluxed at temperatures 5 to 10 degrees lower.

PLIOVIC EDB90V – a dry blending resin on the resin interchangeability list of Underwriters' Laboratories, Inc. This high-purity PVC flows freely, disperses readily – can be fed right into extrusion equipment.

Blends of PLIOVIC resins offer such advantages as: smaller concentrations of plasticizer, closer control of plastisol flow and fusion over a complete range of hardness.

More information and complete technical assistance on all PLIOVIC resins are yours for the asking. Simply call the Goodyear Chemical Division Field Office nearest you.

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GOODYEAR

CHEMICAL DIVISION

Pliovic–T.M. The Goodyear Tire & Rubber Company, Akron, Ohio

Photos courtesy of the following companies: Royal Electric Corporation, Pawtucket, R. I.; United Plastics & Development Company, Kent, Ohio; Akron Presform Mold Company, Cuyahoga Falls, Ohio; Bedminster Sound Corp., Belleville, N. J.

THE PALLMANN PULVERIZER

THE MOST ECONOMICAL WAY TO PULVERIZE THERMOPLASTICS

A NEW CONCEPT: PULVERIZING THERMOPLASTICS TO FINE MESHES WITHOUT FIRST FREEZING THE PLASTIC

GRANULES OR FILM
VIRGIN OR SCRAP

PRESENT PROCESSES

- Pulverized polyethylene for sprinkling on and subsequent melting into textiles
- Pulverized rigid vinyl scrap for blending with flexible vinyl polymer in calendering and extruding
- Pulverized plastics for intimate dispersion in compounding
- Densifying film scrap for re-extrusion
- Engel molding process
- Breaking up agglomerates

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SOFT AND RIGID PVC's

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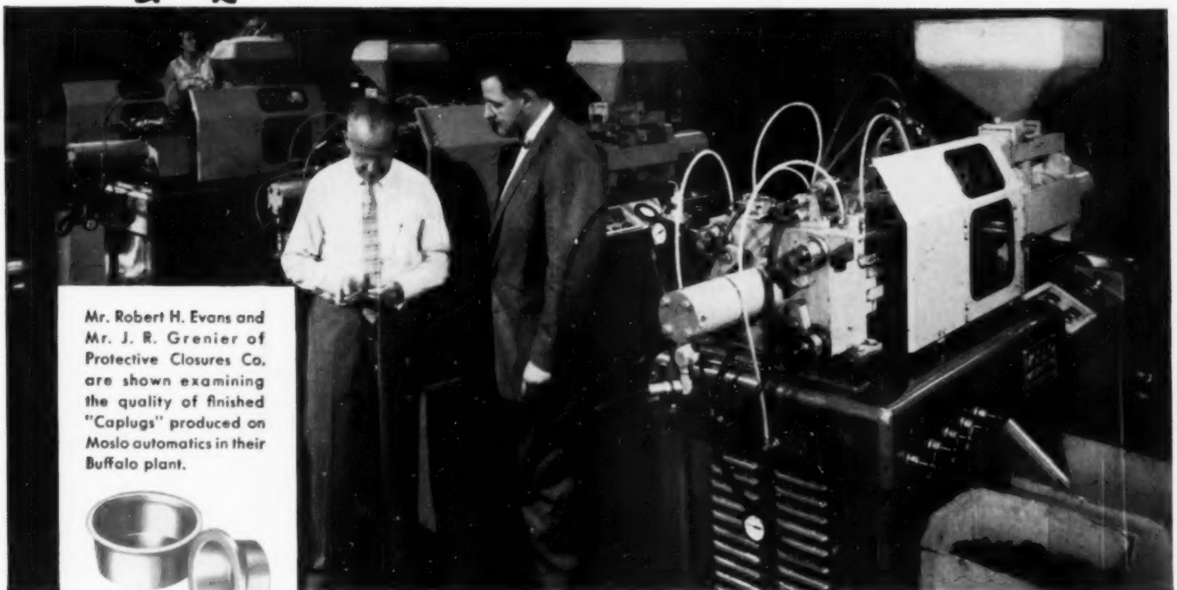
profits three ways

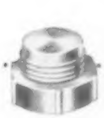


Mr. Robert H. Evans and Mr. J. R. Grenier of Protective Closures Co. are shown examining the quality of finished "Caplugs" produced on Moslo automatics in their Buffalo plant.

Caplugs

with MOSLO Molding Machines

Protective Closures Co., Inc. of Buffalo, New York, is a leading producer of high quality products in the closure industry. In their plant they have a battery of eight MOSLO Model 74 two-ounce automatics to produce their fast-growing line of "Caplugs."



Mr. J. R. Grenier of Protective Closures says, "We selected Moslo presses over larger equipment because less expensive molds, with fewer cavities, can be run fully automatically for greater efficiency and increased profits."

The clean, simple and efficient design of Moslo Plastic Injection Molding Machines, for automatic production of small plastic parts up to 4 ounces can help your profit picture, too. Write today for additional literature on the machines with "Built-in Efficiency."

WORLD'S FINEST PLASTIC INJECTION MOLDING MACHINES

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Please send descriptive literature on
- ☐ Model "74" 2 ounce Automatic
- ☐ Model "75" 4 ounce Automatic
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ACCURACY — *the reason for its wide acceptance!*

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REVERSE ROLL COATER

MODERN DESIGN

RUGGED CONSTRUCTION

CONVENIENT CONTROLS

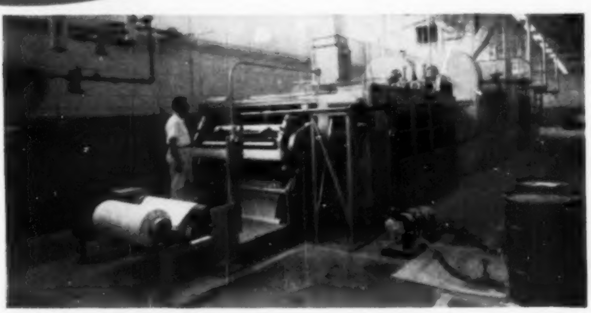
PRECISION MANUFACTURE

VERSATILE

The Waldron Reverse Roll Coater is offered as a *Standard Unit* in widths ranging up to 154 inches. It incorporates many distinctive design and auxiliary features that through years of experience have been found to be advantageous to the customer's operating and maintenance men.

This Waldron Coater is available as a single unit, or as an integral part of completely engineered coating line, as illustrated. In such an integrated line selected standard Waldron Web-Processing Units are used in combination with the Waldron Reverse Roll Coater and with the drying equipment designed by our Ross Division, specialists in air systems.

Our technical bulletin on Reverse Roll Coating gives full details. We'll be glad to send you a copy; also a bulletin describing how companies like yours can use our fully equipped and staffed coating and drying laboratory for test and development purposes.



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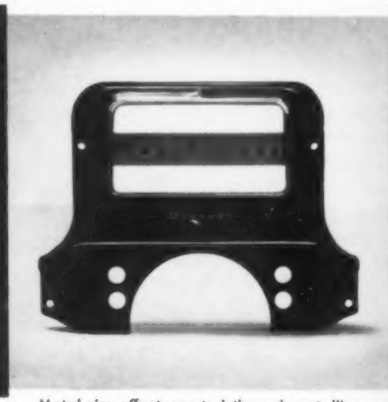
Hit this New Sales Jackpot with VACUUM METALLIZING

Dramatic taillight lens of the Ford Thunderbird utilizes vacuum metallizing on inside surfaces.



Metal rim effect created through metallizing on instrument panel on Bonanza Airplane by Beechcraft made by metallizing.

New light weight metallized plastic arm rest on Pontiac, Buick and reflector on rear arm rest of Chevy's Impala, are less expensive than metal, look better.

Help Detroit win the battle against costs and weight and you'll bring home the sweetest slice of business you ever saw! And you can do it with vacuum metallized plastics!

Take a peek at the Mercury or Thunderbird taillights, the new arm rests for the Buick and Pontiac, or the smart backup plate on the Impala arm rest and see if these examples don't stimulate your imagination. It may also be worth your while to look over the instrument panel or aircraft interiors and chalk up another market with boundless opportunities for sales.

Best of all, you don't have to know anything about vacuum metallizing to get started. Buy the equipment from us; we will install it, train your operators, and help you set up a production operation.

Send us a sample part and we will finish it FREE. We will also estimate the cost per piece without obligation. Will you ship today?

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NEW DESIGNS IN MARLEX

New 1960 Fords have seat panels molded from scuff-resistant MARLEX*

The all-new 1960 Fords incorporate many innovations in both design and materials. Ford's selection of linear polyethylene for the side shields for the front seat cushions represents *the first major use of this material in the automotive industry!*

Ford used linear polyethylene for this component because it was the only type of material that offered all of the following advantages. (1) Lower piece price . . . *linear polyethylene parts cost 1/5 less than painted steel parts.* (2) Lower tooling price . . . *2/5 the cost of formed steel.* (3) Styling . . . *graining and grooved surfaces obtained easier and at reduced cost.* (4) No seat abrasion . . . *no wear on adjacent upholstery from seat flexure.* (5) Increased scuff-resistance . . . *integral molding of color and graining far superior to painted steel.* (6) No denting . . . *no dent marks in linear polyethylene parts at −20°F to +200°F.* (7) Lighter weight . . . *2.8 lbs. per car less than with steel components!*

Ford ran tests on color and dimensional stability, impact, softening and cycle fatigue characteristics. The linear polyethylene parts proved superior to those made of painted steel. In fact, no other type of material serves so well and so economically for so many different applications.

*MARLEX is a trademark for Phillips family of olefin polymers.

PHILLIPS CHEMICAL COMPANY, Bartlesville, Oklahoma

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PHILLIPS 66 MARLEX PLASTIC

THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 1

December 1959

Molding and extrusion in 1965. Around 1.67 billion lb. of plastics will be molded or extruded in 1959; by 1965, the figure will have grown to 2.8 billions. This startling summary was presented in a paper prepared and read by J. K. Honish of Union Carbide Plastics Co. before a recent meeting of the Chemical Market Research Association. (The figures include films; they also include resin used in blow and slush molding, as well as thermoforming, in addition to conventional molding processes.)

Mr. Honish's estimates for 1959 and 1965 molding and extrusion resin consumption, in millions of lb. are: olefins, 364.6 and 890.0; styrene, 538.2 and 665.0; vinyls, 295.1 and 508.0; cellulosics, 98.4 and 120.0; phenolics, 203.4 and 255.0; urea-melamine, 116.4 and 160.0; miscellaneous, 54.8 and 208.0.

In forecasting consumption by end uses (molding and extrusion only), he listed the following for 1959 and 1965 in millions of lb.: personal products, 215.0 and 318.4; household and office equipment, 216.7 and 402.3; appliances, 294.8 and 431.0; transportation, 61.2 and 120.2; construction, 181.1 and 275.3; packaging, 169.1 and 365.2.

Other factors for growth. Mr. Honish was very careful to point out that these increases are based primarily on population growth of from 178.8 million in 1959 to 192.2 million in 1965, with increase in per capita consumption based upon 100% growth of plastics usage from 1953 to 1959. He noted that no additional improvement factor is included which might be created by sales promotion, product development, and design capabilities. His base figures were admittedly those published by the U. S. Tariff Commission.

It would be interesting to know what the planning and research departments in Union Carbide and other plastics producers think about the additional growth that could come from product improvement, better processing equipment, and lower costs. Lower-priced resins with higher heat resistance, better weatherability, faster put-through, tailor-made for specific jobs, could broaden the plastics base by thousands of tons.

No chemical company is going to expose its innermost thoughts on markets that may be affected by as yet undisclosed future plans. But could anyone believe that as yet unannounced and undiscovered materials and processing techniques will not increase the industry's volume? It now seems clear that many sales managers of thermoplastic resins will be in danger of losing their heads in 1965 if their sales haven't increased by a greater percentage than population growth.

Two new film grade resins by Grace: A 0.940 and a 0.960 density resin have been announced by Polymer Chemicals Div. of W. R. Grace & Co. The 0.940 density is suggested for overwrap applications and packaging bags. Advantages over lower-density PE films are claimed to be more stiffness for better handling on automatic equipment and improved barrier properties. It is claimed to have improved shelf life and to be less expensive than cellophane. (To page 41)

*Reg. U. S. Pat. Off.

THE PLASTISCOPE

(Continued from page 39)

The 0.960 density is intended for extrusion of heavy-gage film (4 to 10 mils) to replace paper carton stock and for production of thermoformed packages with heat-sealed lids. It can be chilled-roll extruded into rigid film or sheet with high gloss, decorated by lithography, and used for packaging frozen, boil-in-package foods.

Note: There is now a great deal of activity throughout the industry in these higher-density PE films. Progress has been slow but there are indications that such film is about to go over the hump—may have a good, sizable volume in certain types of applications before the end of 1960. This applies to both types of PE—the low-pressure people are coming down in densities and high-pressure producers are either raising the density of their resin or finding other ways to improve film made from high-pressure-produced resin so that it will have the properties of stiffness and clarity which are required for flat wrapping and machine handling.

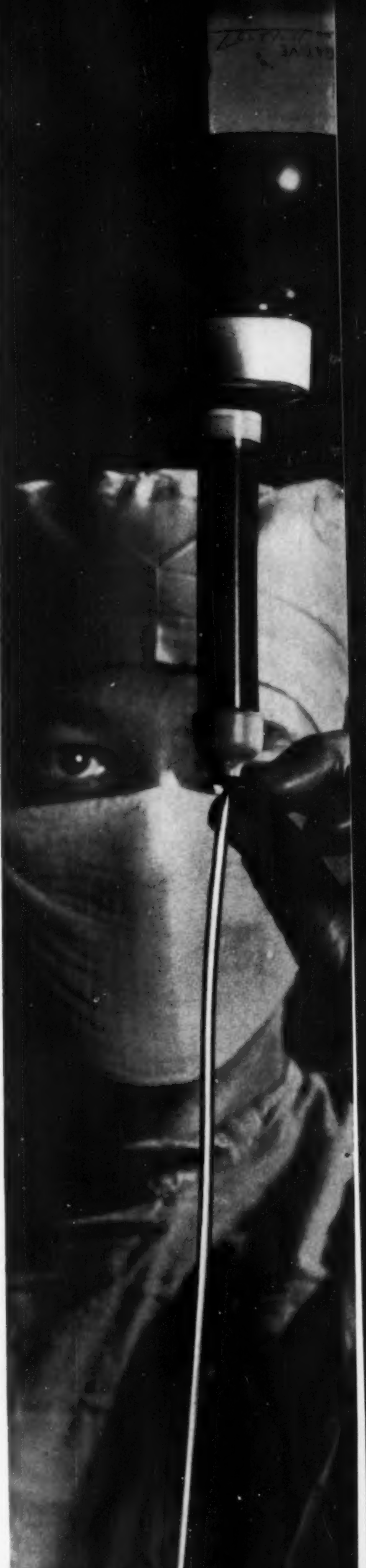
Polyethylene for flat wrapping: A footnote to the above comment on high-density PE is the announcement from Scandia Packaging Machinery Co. that development of a new technique for sealing now makes it possible to handle high-density PE on high-speed wrapping equipment without specially designed machines or elaborate conversions. Developed by Phillips Chemical Co. and adapted to a Scandia cigarette wrapping machine, the new technique features a simple slide-through seal of the cellophane type at one sealing station. The technique is based on specially coated heating plates that control surface temperatures—there would be no need for long belts to carry packages through specially designed heating stations. The machine can be used for either high-density polyethylene film or cellophane.

More information on new methacrylate. J. T. Baker Chemical Co., Phillipsburg, N. J., has released more information on the company's new high-heat resistant acrylic-type resin, PL 11. An outstanding property is retention of its optical properties under prolonged exposure to boiling water. Samples boiled in water for 6 months were said to be unchanged. Injection molded samples have been subjected to repeated steam sterilization at 5-lb. pressure without loss of transparency or shape, it is stated. The heat resistance of the material seems to be due to increased interaction between the molecular chains, with a resultant increase in melt viscosity over methyl methacrylate polymers, according to company information.

Rubber-like material for plastics processors. Estane 5740 X1 is a rubber-like material that can be processed on plastics equipment—molding, extrusion, calendering, and coating. Spokesmen for the producer, B. F. Goodrich Chemical Co., say it is tougher than any other plastic. It is a poly (ester-urethane) elastomer, which is believed to be essentially a linear polymer and which behaves as a typical thermoplastic. It differs from conventional urethanes in that it can be reprocessed.

Estane has a tensile strength of 1000 p.s.i. at a flash temperature of 220° F., 6000 p.s.i. at room temperature. It is also flexible at **(To page 43)**

where quality is a matter of life or death



In the manufacture of medical tubing there is no margin for error . . . human lives hang in the balance. That is why manufacturers of medical tubing and apparatus have adopted VYGEN 120 . . . the quality PVC resin that satisfies the rigid government specifications. VYGEN 120 is not just another quality resin, but one of a family of specialized resins developed and manufactured to meet the requirements of the processor and the demands of the end product. No matter what your processing requirement, you should look to the VYGEN family of PVC resins just right for every application. For complete information call or write us today!

VYGEN®

VYGEN 85—Recommended for calendering, extrusion and molding operations where processing at low temperatures is desired.

VYGEN 105—For light-embossed sheeting and for molded items and extrusions requiring high gloss finish.

VYGEN 110—General purpose resin for calendered film, sheeting and coated fabrics . . . molding and extruding. Excellent heat and light stability.

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Chemicals for the rubber, paint, paper, textile, plastics and other industries: **GENTRO SBR** *rubber* **GENTRO-JET** *black masterbatch* • **GEN-FLO** *styrene-butadiene latices* • **GEN-TAC** *vinyl pyridine latex* **GENTHANE** *polyurethane elastomer* • **ACRI-FLO** *styrene-acrylic latices* • **VYGEN PVC** *resins and compounds* • **KURE-BLEND** TMTD *masterbatch* • **KO-BLEND** *insoluble sulfur masterbatch*

THE PLASTISCOPE

(Continued from page 41)

—100° F. These, of course, are extremes. The company describes a usable temperature level as ranging from —70 to 180° F.

Suggested injection or compression molded products are football cleats, shoe heel lifts, pallet wheels, gears, guide rollers. It can be extruded for wire and cable jacket, for automobile door welting and on fabric for hydraulic oil hose covers. It can be extruded or calendered into film or sheet for automotive scuff pads, ball covers, packaging, coatings, tank linings. It can be used as a solvent coating with tetrahydrofuran, MEK, and other solvents for awnings, tents, outdoor clothing, flooring, aircraft wing linings.

The present price in pilot-plant quantities is $1.85 a lb., but is expected to be much lower when it comes into commercial production.

Vinyl film prices. Vinyl film has declined in price from $1.03 a pound in truck load quantities in 1946 to 50¢ in 1959. When Goodyear recently raised the price 2¢ a pound it was the first increase in all those years, although there have been adjustments along the way because of chaotic conditions created by cut-cost merchandising. During this period price of resin has declined considerably, but not enough to make up for rises in costs of machinery and equipment, and a dollar-an-hour rise in labor costs. There are indications that the 52¢ price may go still higher, since film producers claim that the present price still isn't enough to amortize new equipment and develop new products. New product development has been sadly neglected in the past, as shown by the leveling off of vinyl film consumption until the new spurt which started early in 1959 and which followed the general rise in all industry production.

All out for vinyl-metal laminates. B. F. Goodrich Chemical Co. is pulling all stops in the promotion of this material which may be formed by laminating sheet, casting plastisol, or dip coating plastisol. In a recent Chicago, Ill. talk, E. B. Osborne, Market Manager of the company's Calendering and Coating Materials, said the 1958 market was between 30 and 40 million sq. ft. that were fabricated into 27 million units, such as housings for appliances, radios, etc. Over 50 million sq. ft. are expected in 1960; and a future market of one billion does not seem impossible.

Vinyl-coated aluminum sidings for construction purposes are among the most exciting of the prospects. Both sides are coated with 1- to 20-mil thicknesses before the siding or awnings are fabricated. An aluminum boat with a vinyl clad deck is now under construction. The vinyl may be formulated to stand up under 160° F. on a continuous basis but will soften at 350° F. and char at temperatures above 400°.

Among other present applications are the 26,000 hooks used on a conveyor system in a Ford plant; a Burroughs machine for sorting letters in the Detroit post office; railroad car and automobile interiors; a compact new travel-lav, or lavatory, an electric heater. Big future markets are in kitchen cabinets, office equipment, luggage, partitions, dishwasher equipment.

It is significant that steel companies are vigorously pushing adoption of this type of metal laminate. One big steel company has also installed a complete array of vinyl-metal coated desks in its head office. **(To page 45)**

THE PLASTISCOPE

(Continued from page 43)

Teflon fluorocarbon film. Availability of Du Pont's Teflon FEP in film form is expected to broaden markets for fluorocarbons by substantial volume. FEP is distinguished from the older TFE fluorocarbons in that it can be molded or extruded in conventional equipment. Most of the market is now in the electrical field, but it is destined for other fields also. The film, for example, can be used as a laminate over almost any kind of substrate, such as asbestos or steel, where its temperature range at continuous exposure is from −85 to 200° C. and from −85 to 250° C. for intermittent service. Its outdoor resistance is claimed to be second to none in the plastics field.

Teflon film is as "slippery as ice" and therefore has exceptional release or nonstick properties for use in molds for plastics such as urethane, or in candy where the molds can be vacuum formed from Teflon. Its chemical inertness makes it especially valuable for tank and pipe lining. Its nonstick properties make it useful for conveyor belts in food lines; however, it can be bonded or cemented to other substances.

The base price, when the material is in commercial production, will be $15/lb., or about 17¢/sq. ft./mil. Two mil thickness is now the base item, but it can be made in thicknesses under one-half and up to 40 mils.

Patent situation in slush molding. The U. S. Circuit Court of Appeals in Cincinnati has affirmed the validity of two Sun Rubber (Barberton) patents relating to rotational slush molding of plastisols. Sun halted operations and went into voluntary bankruptcy over a year and a half ago when it lost a suit for infringement of its patents. The reversal of this decision by the Court of Appeals resulted in Sun president T. W. Smith Jr.'s declaration that he would reactivate the plant and resume manufacturing soon. A few years ago the company employed 1000 persons. The patent infringement suits had been filed against Akron Presform Mold and National Latex in July, 1954, both of whom are expected to ask for a rehearing since the ruling was made on a split decision by the three judges. The patents involved both the process and a machine for slush molding. The question now in the minds of slush molders is: will the rehearing reaffirm the Appeal Court's decision that infringement had taken place and if so, will more licenses be available from Sun than the three licenses that had previously been granted?

Rexall grows again. The Salinas, Calif. facilities of Package Containers Inc. have been purchased by Chippewa Plastics Co., a division of The Rexall Drug and Chemical Co. The plant will become Chippewa's Flexible Packaging Div., and will cover the whole range of flexible packaging, including polyethylene film, foils, and cellophane. In addition to producing bags, the division will manufacture overwraps, heavy-duty industrial bags, and drum liners.

The Salinas operation opened in 1954 as the Flexible Packaging Div. of Growers Container Co., a cooperative venture of Salinas Valley produce growers. In 1955, the company constructed a modern, air-conditioned plant with floor space of approximately 50,000 sq. feet. In 1957, Package Container, Inc., Portland, Ore., purchased the facilities.

For additional and more detailed news see Section 2, starting on p. 230

LETTERS TO MODERN PLASTICS

Where readers may voice their opinions on any phase of the plastics industries. The editors take no responsibility for opinions expressed.

Supports Plastics Institute

Sir: The industry is overdue for an Institute that will solve its broad and overlapping problems. It is reassuring to see MODERN PLASTICS publish Ralph Mondano's letter (MPl, Oct. 1959, p. 44) because your publication indicates your recognition of the gains that will come to all through this plan.

We have so many basic problems that will be solved only by universal support of an industry-wide laboratory—operated for the total good of the industry. It is our intense desire to support this program in every way we can.

J. H. Du Bois,
Chairman of the Board
Tech-Art Plastics Co.
Morristown, N. J.

A basic question

Sir: Upon reading the interesting article written by R. L. Ballman, Tevis Shusman, and H. L. Toor beginning on p. 105 of your September issue entitled "Injection molding: A rheological interpretation—Part I," I find a basic question.

The sophisticated mathematical flow analysis presented has as a major premise the fact that a polymer melt is incompressible. The authors stated this assumption on p. 108. This premise exerts a fundamental influence throughout the mathematical interpretation of flow shown by the authors.

Work done by Matsuoko and Maxwell, as well as the undersigned and Maxwell at Princeton University, has shown polymer melts to be quite compressible. This work contradicts the aforementioned assumption. Matsuoko was able to show that polyethylene, for instance, will develop a higher state of crystallinity under high pressure. Additional work with polystyrene showed a distinct transition between the glassy and visco-elastic states.

Research done by the undersigned the compressibility of polymers. We and Maxwell further substantiated were able to show that high pressures on a material like polystyrene would increase the polymer melt viscosity almost exponentially. Under sufficient pressure the melt would act like a solid plug and flow would cease.

It follows, therefore, that if the Princeton research is valid then the equations shown in the article are highly idealized. I will be interested in the next article (See MPl, Oct. 1959, p. 115.) where the authors correlate theory with actual results. It would seem almost impossible to develop a truly accurate flow equation for an actual injection molding operation in view of the many vague and uncontrollable variables.

The work by Messrs. Ballman, Shusman, and Toor, nevertheless, is very worthy of publication and certainly is a definite step forward in the battle to better understand injection molding.

A. Jung
Plastics Dept.
Rohm & Haas Co.
Los Angeles 36, Calif.

Mr. Jung's point is well taken—however, like the bumble bee which doesn't know it aerodynamically can't fly—the equations seem to work."—Ed.

About PE for food wrap

Sir: Presumably, because of the experience with certain paraffinic waxes of natural origin, the question has been raised as to whether polyethylene contains any traces of polynuclear hydrocarbon of known or suspected carcinogenic activity. The most telling evidence, of course, is experimental. Every manufacturer of polyethylene in the United States has by now accumulated evidence indicating the total absence of such substances from polyethylene. In addition and perhaps just as important, the known mechanics and kinetics of ethylene polymerization dictate the absence of polynuclear aromatic hydrocarbons from polyethylene, whether they are produced by either high-pressure or low-pressure techniques.

Let us first point up a basic difference between *addition* polymerization, which is the generic term covering polyethylene produced by either high- or low-pressure techniques, and *condensation* polymerization, which is the generic term covering the formation of polyesters and related plastics. In *addition* polymerization, *all* of the starting material or monomer consumed in the reaction ends up in the polymer. In *condensation* polymerization, however, the splitting out of a simple molecule, such as water, is essential to the chain building process. In *addition* polymerization the monomer, such as ethylene, possesses inherently the driving force that will convert it almost instantaneously into a high polymer under the influence of catalyst, heat, and pressure. There are three stages involved in the formation of any polyethylene molecule—initiation, propagation, and termination. At any stage of conversion of ethylene to polymer, if one analyzes the reaction mixture, he finds only a mixture of ethylene monomer and final high polymer—no intermediate low polymer. Thus, polymer is not produced in gradual stages.

In *condensation* polymerization, however, a very gradual build-up in molecular weight of all monomer and low polymer species present occurs. In addition, there is competition between the reaction leading to linear high polymers and that leading to cyclic dimers, trimers, tetramers, etc. Here, indeed, is probably the point where much of the confusion and unwarranted concern about polyethylene arose. Reasoning by analogy from *condensation* polymerization some persons have expressed concern about the possible presence of "cyclic" materials in polyethylene. The mechanism outlined above for *addition* polymerization of ethylene illustrates the fallacy of this proposal. In addition, cyclic structures which might be derived from ethylene on paper, such as cyclohexane, cyclooctane, etc., would not be carcinogenic. They are a far cry from such conjugated aromatic polynuclear hydrocarbons as dibenzanthracene which are known to be carcinogenic.

For the simple molecule of ethylene to undergo the contortions and gyrations necessary to arrive at the configuration of dibenzanthracene would require mechanisms entirely foreign to those demonstrable by experimental organic chemistry or polymer science. Such resonating polynuclear structures might be conjectured from acetylene by a rather far-fetched stretch of the imagination, but it is never possible from ethylene.

Dr. George E. Ham,
Director, Technical Department
Plastics Division
Spencer Chemical Co.
Kansas City, Mo.


Merry Christmas
COLUMBIAN CARBON
COMPANY

NEW MACHINERY-EQUIPMENT

Specifications, claims made, and prices appearing in these pages are those of the manufacturers or sellers of the machinery and equipment described, or their agents.*

High temperature press

For research and development and for processing high-temperature materials, 50-ton compression press is capable of operating with sustained platen temperatures of 1500° F. Temperatures are individually controlled and are continuously recorded. Platens are 12½ by 18½ inches. Sufficient insulation of the platen is provided to keep the press frame cold. Press is supplied with

PASADENA HYDRAULICS new compression press develops sustained platen temperatures up to 1500° F.

motorized hydraulic system, including variable closing and pressing speeds, and a control console with three gages for measuring pressure over the entire range available up to 50 tons. *Pasadena Hydraulics Inc., 1433 Lidcombe, El Monte, Calif.*

Blow molding machine

Suitable for the production of blow molded articles up to 3½ in. diam. by 6 in. long, the Blow-Master is capable of production rates up to 600 articles/hr. The machine has 3 mold platens: left, center, and right. The left and right platens are stationary, while the center platen shuttles between the two. The mating halves of each of two molds are mounted between the left and center platen. As the center platen shuttles to the left, it clamps the left mold and blows the part. Meanwhile, another tube is extruded as the left part cools. The center platen then moves to the right, picks up the parison and clamps the right mold; right side part is blown while the left side part is ejected and drops out of the machine. Operation is completely automatic and continuous. The machine is self contained and is supplied with its own 1⅝-in. extruder with a speed range of 20 to 80 r.p.m.; L/D ratio of 16:1 and a compression ratio of 3:1. Heating capacity is 6 kw. The blow molding machine portion requires 60 p.s.i. air and 230-v. 3-phase, 50-cps. power. *Amigo Machine Co. Ltd., 16 Gorst Rd., London, N.W. 10, England.*

Pipe puller

Heavy duty three- and six-belt types of pipe pulling units are now being offered in a number of sizes. The three-belt machine will pull pipe in sizes ranging from ½ to 8 in., while the six-belt unit will take diameters from 2 to 12 inches. Larger sizes are available on special order. The adjustment for various pipe sizes on each machine is accomplished by means of a handwheel, thus eliminating the need to change any parts. The pulling section in contact with the pipe is 2 ft. long, thus providing efficient pull within small floor space requirements. *Frank W. Egan & Co., South Adamsville Rd., Somerville, N. J.*

5-kw. plastic sealer

Model C-74 high frequency sealer (27.12 mc.) will seal such items as an entire plastic looseleaf notebook cover or three pocket secretaries in a single 3-sec. cycle. Working platen area is 23 by 29 in., and the upper die holder area is 15 by 23 inches. A 4½-in. I.D. air cylinder provides a 6-in. press stroke and will develop 1500 lb. clamping force at 100 p.s.i. air line pressure. Unit comes equipped with continuously variable vacuum capacitor power control, automatic heat cycle timer, pilot lights for filament voltage and sealing power circuits, hand or foot operated press closing and foot operated r.-f. power switches. Forced air is used for cooling and safety interlocks are provided. Power input is 230 v. single phase a.c. Price range, depending on accessories, is $3200 to $3600. *Reeve Electronics Inc., 617 W. Lake St., Chicago 6, Ill.*

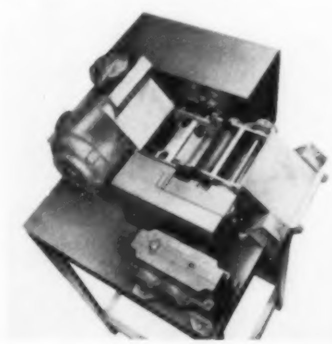
Electron accelerator

Especially suited for the irradiation of thin plastic films and wire coatings, the Dynamitron, Model EA-K500 provides a 500,000 v. electron with a 7.5 kw. output at constant potential. The output at 100% efficiency will process 6000 megarad-lb./hr. Scan widths up to 36 in. are available with high beam current, low cost per kilowatt output. The unit is 3 ft. in diameter and 6 ft. long, excluding the beam extension system. The complete accelerator system includes the high voltage generator, r.-f. oscillator, and a control console. Double as well as single scan configurations can be provided with this machine. *Radiation Dynamics Inc. Westbury, N. Y.*

Pelletizer

For cutting plastic material to a uniform pellet size, the new Pelletmaster is available in two models, with 7 and 12 in. pelletizing chamber widths. Rotor speed is synchronized to the feed rolls which are geared for variable speed operation to conform to the rate of extru- **(To page 50)**

BALL & JEWELL 7-in. pelletizer (top view) has rotor speed synchronized to feed rolls, cuts uniform pellets.



* Prices are deemed to be F.O.B. sellers' plants (unless otherwise stated), are for "standard" models, and are subject to change without notice. The publishers and editors of MODERN PLASTICS do not warrant and do not assume any responsibility whatsoever for the correctness of the same, or otherwise.

NYLON?

VAN DORN Presses mold it better

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1. Better material control
2. Close tolerances easier to maintain
3. Lower mold investment
4. Less waste in purging
5. Automatic cycling

Many additional outstanding features of Van Dorn Presses are described in literature available on request.

(From page 48)

sion. The 7-in. unit operates within a range of 20 to 140 ft./min., and the 12-in. model at speeds from 30 to 210 ft./min. Power is supplied by 3- and 5-hp. motors, respectively. Both models feature a U. S. Varispeed drive and hardened steel gears and sprockets. Operation is at a very low noise level. *Ball & Jewell Inc., 24 Franklin St., Brooklyn 22, N. Y.*

Film slitter

The Kiefel slitter is intended for short production runs. Rolls as narrow as ½ in. may be accurately slit and wound. Separate friction controls provide proper winding tension to produce evenly wound rolls. Operating speed is about 80 ft./min. The unit includes an automatic yardage counter, interchangeable feed and take-up rolls, twin take-up shafts, gear motor control of cutting speeds, and an adjustable spring-action conical brake for the feed roller, which eliminates possibility of backlash. *Leedpak Inc., 294 Fifth Ave., New York 1, N. Y.*

Compression presses

Completely automatic 150-, 200-, and 300-ton compression and transfer molding machines have platen sizes between rods of 20 by 24 in., 30 by 39 in. and 36 by 30 in. respectively. Maximum daylight for the two smaller machines is 38 in.; 42 in. for the 300-ton press. Standard design of the presses include top and bottom hydraulic ejection systems; positive air "hold down" or "hold up" to make parts remain in the desired portion of the mold; and heat-insulated die mounting plates. Available as optional equipment is an automatic dielectric pre-heater loader (this can be purchased separately for use with existing presses). Machine cycle time is about 12 to 15 sec. and actual total cycles of less than 50 sec. have been reported. Press may be changed from compression to transfer by flipping a switch. *Rodgers Hydraulic Inc., 7401 Walker St., Minneapolis 26, Minn.*

Temperature control valve

Model 90 water temperature regulating valve provides positive, low-cost control for any industrial cooling system—cuts costs automatically by supplying only the exact amount of water required for each particular application. The valve maintains positive temperature control to within 2 degrees. Two models cover the following temperature ranges: Model 90L, adjustable from 60 to 120° F., and Model 90H, adjustable from 100 to 160° F. can be used with pressures up to 125 p.s.i.—in conjunction with heat exchangers, water chillers, and other temperature regulating equipment. Water flow: 9 gal./min. with 30-lb. drop. Unit comes with ½-in. line strainer, bleeder assembly, and thermometer. *Vic Mfg. Co., 1313 Hawthorne Ave., Minneapolis 3, Minn.*

Micro gage

For checking dimensions on precision molded plastic parts, such as nylon gears, a new simplified Wilder small parts comparator designated Model C has magnification of 10X to 100X, with lenses having maximum fields of view from 0.625 to 0.080 inch. Size of the work stage is 4 by 6⅝ in. with 1-in. diam. stage glass. By projecting a focused beam of light past a specimen and through a magnifying set of lenses, a shadowgraph of the part is thrown on a calibrated visual display screen. The dimensions of the part can then be checked against the calibrated standard for accuracy and quality. Special attachments for the comparator are optional. Price of standard model: $400. *Opto-Metric Tools, Inc., 137 Varick St., New York 13, N.Y.*

OPTO-METRIC Wilder optical comparator can be used for checking parts' dimensions when breaking in new precision molds.

RODGERS HYDRAULIC'S new line of completely automatic compression and transfer molding presses is available in 150-, 200-, and 300-ton sizes.

Roll cutter

Model 360-V4 heavy-duty single-knife cutter slits practically all plastic films from ¼ to 30 mils into rolls without rewinding. The machine will handle rolls up to 72 in. wide. Cut edges are perfectly flat and the material is guaranteed not to fuse. Rolls can be slit in 8 to 10 min., compared to up to 1½ hr. for conventionally slit and wound thin gage films. The machine does not require an experienced operator and can be run continuously round-the-clock. Controls are conveniently mounted on the machine. *Oscar I. Judelshon Inc., 148 Greene St., New York, N. Y.*

Tile cutter

The Tilematic plastic tile cutter cuts or bends polystyrene tile using a heated blade which melts or softens the tile at the point of contact. The blade is heated by an isolation transformer whose primary **(To page 52)**

PRODEX EXTRUDERS

AND COMPLETE EXTRUSION SYSTEMS

COST LESS

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Designation by screw diameter is out of date for modern extrusion machines, since screw diameter is no longer the determining factor of output performance.

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- They produce more pounds per hour with higher precision because of their advanced screw design combined with valving—in many cases a two stage screw.
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- Before you buy another extrusion machine, investigate the extraordinary PRODEX. It is most likely that your production requirements will be fulfilled by a PRODEX EXTRUDER one size smaller. We will gladly demonstrate this to you with your own material in our customer service laboratory. Telephone or write us for an appointment.

Complete PRODEX EXTRUSION SYSTEMS are available for sheet, roll cast film, pipe, wire and cable, compounding. Prodex extruders are available in sizes ranging from 1¾" through 8" with L/D ratios of 20: 1, 24: 1 and longer...with or without venting.

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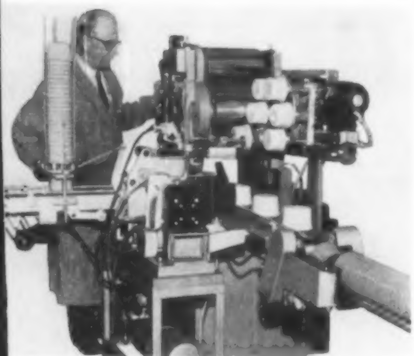
(From page 50)

operates on 110-v. 60-cps a. c. and has an output of 3½ volts. Blade material is Nichrome wire. Entire circuit is designed to produce a constant blade temperature. Price about $12.50. *Vido Products Inc., Marion St., Grand Haven, Mich.*

Side wall printer

The Cosomatic rotary-flexographic printer is used for side wall printing of open end containers and cylindrical molded items. Changes in operating speeds and an increased number of spindles on the indexing drums



COSOMATIC rotary flexographic printer will print up to three colors on sides of molded containers.

of the rotary printer have resulted in production printing rates on open end containers of 3000 to 4200 parts per hour. The flexographic machine will print up to three colors simultaneously or two colors and an application of overprint varnish. Positive drive, precision ink control, roll accuracy result in high quality close register printing. Feed and take-off attachments are automated. *Cosom Engineering Corp., 6012 Wayzata Blvd., Minneapolis 16, Minn.*

Nozzle crosshead

Developed for use with the Formaton J automatic molding presses, cross head attachment allows the molder to convert his single nozzle press into a multiple nozzle machine. The nozzle crosshead spacer platen is mounted between the standard platen and the mold and the multiple nozzles are fed by the single standard nozzle. The hot runner system in the crosshead then distributes the melt to the 2, 4, or more, nozzles of the crosshead. With the multiple nozzle system, two different molds can be run in the same press or a single multiple cavity mold. Nozzles are seated in various molds by set screws in the rear of the crosshead. By mounting the system as a crosshead platen, the entire unit can be moved forward with the regular platen, clearing the single conventional nozzle of the press for purging. A 2-nozzle set-up, including crosshead and spacer platen costs $440, exclusive of heater controller. A 4-nozzle set-up costs $550 on the same basis. *Guy P. Harvey & Son Corp., Leominster, Mass.*

Punch press

Model BT-8, 8-ton press is suitable for standard punch press operations on plastics or metals. Die space is 8½ in. shut height, throat 10 inches. The press is equipped with a single pin, knife-type clutch and can be set for continuous or single-stroke action. Also incorporated are V-Type ram gibs and an adjustable ram for die-setting. The die bed is 7 by 12 in. with a bed opening of 4 by 6 inches. Equipped with a 16-in. diam., 3-in. face flywheel weighing 115 lb., the press requires a ½-hp. motor. Standard stroke is 1½ in. with special strokes between ¼ and 3 in. (in ¼-in. steps) available at extra cost. Standard bench-model press, complete with brake, motor mount, V-belt and motor pulley, less motor, is priced at $347.50, F.O.B. Clinton. Split 2-piece ram and ram knockout are optional. Net weight is 430 pounds; shipping weight, 480 pounds. *Alva Allen Industries, 1001-15 N. 3rd St., Clinton, Mo.*

Fatigue testers

Four sizes of Universal Pulsator PUV vertical fatigue testing machines cover a load range from 6 to 20 tons and a frequency range (load cycles) from 600 to 10,000 cycles/min. The large stroke of the PUV models makes them suitable for testing soft materials (plastics, rubber) with low frequencies and rigid parts with high frequencies. The long stroke also allows the machines to be used for torsion and bending tests. An automatic control device with differential relay maintains the originally adjusted preload and alternating load constant within ± 1 to ± 3 percent. In addition, it shuts off the machine in case of excessive material deformation or material fracture. The basic vibrating head movement develops a push-pull action. Attachments are also available. *Cosa Corp., 405 Lexington Ave., New York 17, N. Y.*

Thermocouple wire

Pycopack thermocouple wire, a magnesium oxide-packed, metal sheathed construction can be used where high temperatures, size, and adaptability are primary factors. The wire is supplied in all standard Instrument Society of America calibrations (T, J, K, E, R, and S). Standard sheath O.D.s are 5/16, ¼, 3/16, ⅛, 1/16, 1/25, and 1/40 in.—with standard materials, of 304 stainless steel, Inconel, and platinum. Complete thermocouple assemblies are made to tolerances which permit the use of commercial or M.S. fittings for mounting in pressure systems. *Pyrometer Co. of America Inc., Penndel, Pa.*

Plastics engraver

The No. 252-B-6R name plate engraver is a portable heavy-duty pantagraph with six reduction ratios from 1.5:1 to 4:1. The spindle has an integral micrometer depth control which permits a vertical feed of ¼

MICO plastics engraver can also be used for the milling of shallow dies.

in., regardless of the ratio being used. Stylus and cutter are lifted simultaneously. Machine uses standard tapered-shank cutters. Straight shank cutters of ⅛-in. diam. and midget mills can be used with an adapter chuck. Engraver comes with 6 cutters; 3 each of 2 types. Price: $306. *Mico Instrument Co., 80 Trowbridge St., Cambridge, Mass.*

Correction

"New Machinery-Equipment" (MPl, Nov. 1959, p. 52): Small injection press, the ¾ oz. Super "Wasp" Minijector, is made by Newbury Industries Inc., Newbury, Ohio.—**End**

Introducing **EPOXOL 7-4** . . . by Swift

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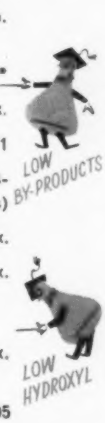
Iodine Value	2 Max.
Gardner Color	Less than 1
Gardner Viscosity 25°C/25°C	0 Max. (3.4-3.7 Poises)
Saponification No.	180 Max.
Acid No.	0.20 Max.
Absorptivity @ 2.9 Microns (Corrected for Background)	0.01 Max.
Specific Gravity 25°C/25°C	0.990-0.995



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WORLD-WIDE PLASTICS DIGEST

Abstracts from the world's literature relative to plastics. For complete articles, send requests direct to publishers. List of addresses is at end of this section.

General

Coloring of plastics. A Haehl. Chim. & Ind. (Paris) *81*, 535-43 (1959). The factors which determine coloring of plastics are pigment dispersion, effect of pigment on transparency or opacity of plastic, migration of dispersed pigment, resistance of pigment to working temperatures, and resistance of colored plastic to light and weathering. The mineral and organic pigments used in coloring phenolic, amino, glycerophthalic, polyester, polyethylene, polystyrene, poly-(vinyl chloride), cellulose acetate, cellulose acetate butyrate, and acrylic as well as nylon plastics are reviewed.

Polyolefins—today and tomorrow. J. C. Swallow. Plastics (London) *24*, 203-06 (June 1959). The technical and economic developments in the field of polyolefins during the past 25 years are surveyed. Various aspects of economic development throughout the world are discussed. Some of the factors which have influenced the growth rate of both high and low pressure polyethylene and polypropylene are presented.

Investigations of the hardening of thermosetting materials during polymerization. P. Dubois, R. Heron, R. Imbert, and P. de Maneville. Rev. Gen. Elec. *68*, 159-62 (1959). From measurements of the resistance and the loss factor of thermosetting plastics as a function of time, it is observed that the loss factor of a resin varies during polymerization with great regularity and reproducibility and that the setting starts at a given frequency, always at the same point on the curve. The setting and stabilization are accelerated by discontinuous low currents. The resistance changes from 10^{9} ohms per centimeter to 10^{13} and more during the transition from viscous to solid state.

Materials

Thermally stable resins and plastics based on the products of interaction of furfural with substances containing a keto group. I. V. Kamenski, V. I. Itinskii, and Yu. I. Korzeneva. Izvest. Vysshikh Ucheb. Zavendenii, Khim. Tekhnol. *2*, no. 1, 89-95 (1959). The procedures for interaction of furfural and ketones for the synthesis of plastics is described. The thermal stability of the polymers made from furfural-ketone monomers depends on the conditions of the reaction and the structure of the keto group component. The higher the heat of reaction and the volume contraction of the reagents, the higher the thermal stability will be.

Condensation polymers containing fluorine. II. Physical characterization of linear polyesters from hexafluoropentanediol. E. V. Gouinlock, Jr., C. J. Verbanic, and G. C. Schweiker. J. Applied Polymer Sci. *1*, 361-70 (May-June 1959). A number of fluorinated polyesters were prepared by condensing hexafluoropentanediol with one or more dibasic acid chlorides. The melting and glassy transition temperatures and rates of crystallization were determined, largely by means of volume dilatometry.

Plasticizers for polyvinyl chloride prepared from byproducts of chemical industry. K. V. Borisova, N. G. Ovechenko, T. V. Smirnova, E. M. Levashova, and I. Nad. Izvest. Vysshikh Ucheb. Zavedenii, Tekhnol. Legkoi Prom. *1959*, no. 1, 57-61. Byproducts of the basic organic synthetic industry were used to synthesize inexpensive plasticizers for polyvinyl chloride. Mixtures of esters of dicarboxylic acids and a fraction of alcohols (b.p. 115 to 140°), mixtures of low-molecular weight dicarboxylic acids and fatty alcohols (b.p. 150 to 220°), and an ester of adipic acid and a fraction of alcohols (g. 155 to 180°) were found to give cheaper and better plasticizers than dibutyl phthalate.

Terylene polyester fiber as a resin reinforcement. W. Glen. Brit. Plastics *32*, 273-76, 294 (June 1959). Polyester fibers and filament yarns are used in woven, non-woven and knitted fabric form as overlays and as total reinforcing materials for polyester, epoxy, and phenolic resins. Chemical and physical properties and impact and abrasion resistance were studied and data are presented on various types of laminates containing all glass fiber, all polyester fiber, or blends of both glass and polyester. The most important uses for polyester reinforced laminates are in chemical plant and electrical applications.

2-Vinylpyridine—versatile intermediate. E. R. Wallsgrove. Mfg. Chemist *30*, no. 5, 206-08 (1959). The physical properties, chemical reactions, polymerization, and copolymerization of 2-vinylpyridine are described, and the ability to introduce new properties into polymers.

Molding and fabricating

Thermal treatment to stabilize and perfect pieces molded from polyamides. J. C. Gomez. Rev. Plasticos (Madrid) *10*, no. 55, 2-12 (1959). Moldings of nylon, when heated to 77 to 100° for 30 min. and cooled slowly in equilibrium, contract somewhat and develop greater crystallinity. The surface can be heated to 230 to 280° by infra-red or hot gases for a few seconds and cooled slowly. The crystallinity of the surface increases and there is an improvement in resistance to deformation as well as in coefficient of friction.

Principles of rotary molding. J. C. Reib. SPE J. *15*, 546-49 (July 1959). The theories, historical background, and types of equipment used in rotary molding processes are discussed. The method is compared, in general, to methods involving the use of flat-bed presses. New developments in equipment, particularly those involving the adaptation of automatic preheating equipment, promise a continuing and increasing use of rotary molding methods.

PVC foams made with solid blowing agents. G. Wick, D. Homann, and P. Schmidt. Kunststoffe *49*, 383-90 (Aug. 1959). The use of blowing agents which on heating decompose with the evolution of gas in the manufacture of foams has made considerable progress. An advantage of this method is that equipment costs are much less than those for gas processes. Cellular materials made by using solid blowing agents possess properties similar to those of foams made by gas blowing.

Applications

Plastics in building from the architect's point of view. R. Gillett. Plastics Inst. Trans. & J. *27*, 101-08 (June 1959). Specific **(To page 56)**

"POLYLITE resins are indispensable to production of our unique foam buoy"

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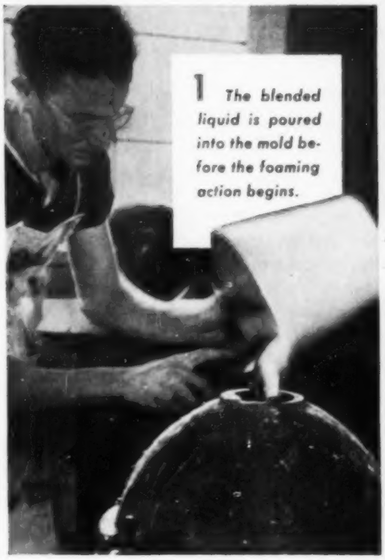

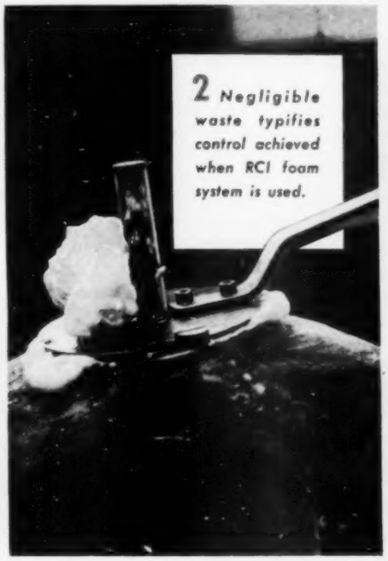

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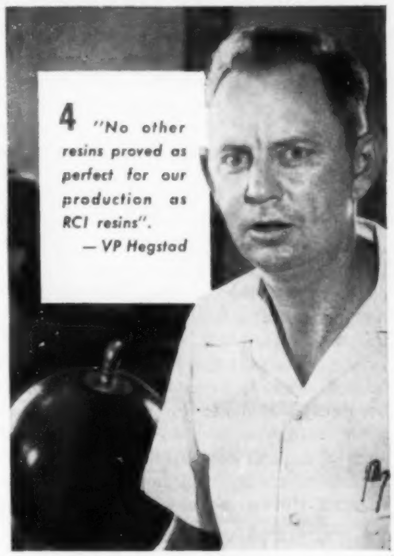

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PLASTICS DIGEST

(From page 54)

applications of plastics are discussed from viewpoint of the architect.

Plastics in the construction of buildings. V. H. Wentworth. Plastic Inst. Trans. & J. *27*, 108-16 (June 1959). New applications of plastics in building construction include styrene plastic linings for concrete forms, foamed plastics for insulating polyester, coatings on masonry, wall coverings, and colored styrene plastic pellets in concrete walls.

Glass-fiber sleeve-springs for high energy absorption. K. Maier. Prod. Eng. *30*, 60-63 (Aug. 17, 1959). Reinforced glass fiber cylindrical springs are described. A continuous, resin-dipped filament is wound in a circumferential fashion to obtain maximum hoop tensile strength. In such a method the elastic limit stress practically equals the ultimate strength of the fibers and there is no flow between the elastic limit and the final breaking strength. A sleeve-barrel combination is described which can withstand the repeated impact of masses moving at speeds over 150 ft./sec. Design features and the stresses generated in the spring assembly are described.

Importance of plastics in coating synthetic fiber fabrics. F. Kassack. Kunststoffe *49*, 425-30 (Aug. 1959). The use of plastics such as polyvinyl chloride, polyurethanes, substituted polybutadiene and polyethylene for coating synthetic fiber based fabrics has produced interesting possibilities with regard to coated materials. Important advantages of such coated fabrics include excellent waterproofness, resistance to weathering, aging, rotting as well as the avoidance of undesirable shrinkage. Furthermore, coating weights may be reduced without adversely affecting tear strength.

Properties

Effect of chemical structure on the softening point of substituted polystyrene and related materials. W. G. Barb. J. Polymer Sci. *37*, 515-32 (June 1959). The concept of a limiting softening point (LSP), defined in relation to a particular standard test method (B.S. 1493) but otherwise only a function of the repeat unit structure of the polymer, is discussed. An approximate correlation of results obtained from different standard methods is given and its limitations analyzed. LSP data are given for polystyrene and 25 different substituted polystyrenes. Analysis of the results suggests the following: 1) The elevating effect of non-polar nuclear substituents is greatest in the ortho position, and increases with the size of the substituent. 2) In the para position, large rigid groups elevate the softening-point whereas the reverse is true of flexible (articulated) groups. 3) Effect of substituents are additive only where they produce the same hindrance to molecular motion. The mechanisms by which substitution can elevate the limiting softening point of polystyrene are (a) stiffening of the main-chain backbone; (b) intramolecular steric hindrance (e.g., *o*-substitution); (c) increased intermolecular steric hindrance; and (d) dipolar attraction.

Flameproof a product. A. R. Gardner. Prod. Eng. *30*, 38-41 (Aug. 3, 1959). The flammability and methods of test of various materials, including plastics, are described. Specifications carry different test procedures, depending on the type of material being tested. The standard test for films is to ignite a vertical strip, for thicker materials a horizontal piece. A radiant panel test is widely applied to plastics for product use. Rigid plastics are surrounded by a heater coil with a spark gap to ignite any evolved gases. Current research is directed towards incorporation of flame retardants into plastics and fibers.

Testing

Infra-red spectrophotometric studies of plastics. R. Sawyer. SPE J. *15*, 537-39 (July 1959). A review of the use of infra-red spectroscopy in the study of polymers is presented. Some general experimental procedures are given for the preparation of samples. Various types of resins are discussed as to their characteristic bands and the type of structural information which might be obtained by infra-red techniques.

Short-time test predicts fatigue strengths of plastics. L. S. Lazar. Materials in Design Eng. *50*, 98-99 (Aug. 1959). Close correlations were obtained between fatigue limits obtained by accelerated fatigue tests and those obtained by conventional long-time Wöhler tests. The Wöhler method requires the application of various alternating, but constant-value, stresses until failure occurs or an arbitrarily chosen number of cycles is reached. An accelerated fatigue test requires progressively increasing the alternating stress. Various linear rates of increase were used and the failure points plotted against the square root of the rate of increase. The technique has been applied to poly(methyl methacrylate), polystyrene, nylon and glass cloth laminates, and the results hold true for all of them.

Chemistry

Irradiation of polyethyene. IV. Oxidation effects. H. Matsuo and M. Dole. J. Phys. Chem *63*, 837-43 (June 1959). The radiolytic oxidation of a linear polyethylene (PE) was studied by measuring changes in total pressure, by observing increases in optical density in the infra-red due to carbonyl absorbance and by analyzing gaseous products of oxidation. The PE film was exposed to gamma-radiation in the initial presence of a few cm. pressure of oxygen. About one-fourth of the combined oxygen appeared as carbonyl and one-eighth as water. Another one-eighth of the oxygen formed a mixture of carbon monoxide and dioxide. Product yields were linear with amount of oxygen consumed whether during the irradiation or in the dark period subsequent to the irradiation. Chemical mechanisms of the reaction are discussed.

Publishers' addresses

British Plastics: Iliffe & Sons, Ltd., Dorset House, Stamford St., London SE1, England.

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Journal of Applied Polymer Science: Interscience Publishers Inc., 250 Fifth Ave., New York 1, N. Y.

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Materials in Design Engineering: Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y.

Plastics Institute Transactions & Journal: The Plastics Institute, 6 Mandeville Pl., London W1, England.

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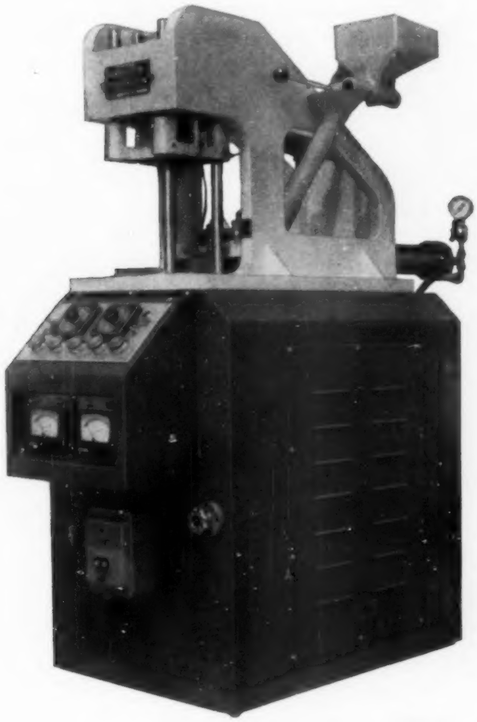

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Salts of hydrolyzed polyacrylate esters. A. Maeder (to Ciba). 2,897,172.

Styrene-allyl alcohol-acrylic ester terpolymers. E. C. Chapin and R. F. Smith (to Monsanto). 2,897,174.

Production of epoxy resins. B. R. Howe and J. H. Turner. 2,897,175.

Chlorine-containing resins. J. F. Rocky and F. R. Nissel (to Union Carbide). 2,897,176.

Resinous polyalcohols. A. M. Partansky and P. G. Schrader (to Dow). 2,897,180.

Polyurethanes. E. Windemuth (to Bayer). 2,897,181.

Oxazine and oxazoline polymers. P. L. de Benneville and L. S. Luskin (to Rohm & Haas). 2,897,182.

Ethylene polymerization. R. J. Christl and M. J. Roedel (to Du Pont). 2,897,183.

U. S. Pats., Aug. 4, 1959

Vinylidene-polyester composition. P. Robitschek and C. T. Bean (to Hooker). 2,898,256.

Polyester-vinyl-heterocyclic nitrogen monomer copolymer. C. E. Wheelock (to Phillips). 2,898,259.

Anion-exchange resins. A. H. Greer (to Pfaudler Permutit). 2,898,310.

Cation-exchange resins. Y. Tsunoda, M. Seko, M. Watanabe, and T. Misumi (to Asahi Kasei Kogyo). 2,898,-311.

Cellular polyvinyl polyester. W. Szukiewicz, A. R. Steimle, and P. H. Rhodes (to P. H. Rhodes). 2,898,312.

Thermosetting resin-bamboo particle composition. R. M. Shepardson. 2,898,314.

Oxygen-containing polymer of cyclopentadiene. O. Roelen (to Ruhrchemie). 2,898,316.

Methyl methacrylate polymer composition. D. H. Coffey and D. G. Guest (to Imperial Chemical). 2,-898,318.

Vinyl ester compositions. J. C. Petropoulos (to American Cyanamid). 2,898,319.

Soil-conditioning. G. S. Sprague and H. Z. Friedlander (to American Cyanamid). 2,898,320.

Phenolic resin-butadiene rubber compositions. A. F. Shepard (to Hooker). 2,898,321-2.

Chloroethylene polymers. G. A. Clark (to Dow). 2,898,323.

Melamine-urea formaldehyde resins. H. A. Mackay (to Catalin). 2,898,324.

Petroleum resins. J. V. Fusco and S. B. Mirviss (to Esso). 2,898,325.

Olefin polymerization. E. F. Peters and B. L. Evering (to Standard Oil). 2,898,326.

Olefin polymerization. W. J. G. McCulloch and A. W. Langer, Jr. (to Esso). 2,898,327.

Olefin polymerization. H. W. B. Reed and W. E. A. Mitchell (to Imperial Chemical). 2,898,328.

Polymerization. A. R. Kittelson (to Esso). 2,898,329.

Ethylene polymerization. H. Isbanjian (to Aries Associates). 2,898,330.

U. S. Pats., Aug. 11, 1959

Vinyl pyridine polymers. C. E. Adams and C. N. Kimberlin, Jr. (to Esso). 2,899,396.

Polyamide-epoxy resin emulsions. D. Aelony and H. Wittcoff (to General Mills). 2,899,397.

Heat-stabilized vinyl compositions. A. E. Pflaumer. 2,899,398.

Ethoxyline resin-shellac-dicyandiamide composition. R. G. Flowers (to General Electric). 2,899,399.

Polysiloxanes. D. W. Lewis (to Westinghouse). 2,899,403.

Terpolymers of styrene, allyl alcohol, and acrylic acid. E. C. Chapin and R. F. Smith (to Monsanto). 2,899,404.

Polymerization of vinyl monomers in the presence of a homopolymer. H. W. Coover (to Eastman Kodak). 2,899,405.

Copolymers of acylamidoguanamines. P. L. de Benneville and L. S. Luskin (to Rohm & Haas). 2,899,406.

Curing epoxy resins. H. A. Cyba (to Universal Oil). 2,899,407.

Copolymers of glycols, sulfonyl dibenzoic acid, and an aniline derivative. J. R. Caldwell and J. W. Wellman (to Eastman Kodak). 2,899,408.

Elastomeric diisocyanate polymers. G. A. Nesty and E. W. Pietrusza (to Allied Chemical). 2,899, 409.

Polymethylene teraphthalates. N. Standring (to Imperial Chemical). 2,899,410.

Polyurethane elastomers. C. S. Shollenberger (to B. F. Goodrich). 2,899,411.

Persulfone resins. J. R. Caldwell and E. H. Hill (to Eastman Kodak). 2,899,412

Olefin polymerization. H. J. Hagemeyer, Jr. and M. B. Edwards (to Eastman Kodak). 2,899,413.

Olefin polymerization with ultrasonic waves. T. S. Mertes (to Sun Oil). 2,899,414.

Coordination polymerization catalysts. W. L. Truett (to Du Pont). 2,899,415.

Polymerization. G. W. Hooker (to Koppers). 2,899,417.

Olefin polymerization. W. B. Reynolds (to Phillips). 2,899,418.

Olefin polymerization. R. R. Chambers, R. H. Elkins, and J. J. Monagle (to Sinclair). 2,899,419.

U. S. Pats., Aug. 18, 1959

Polyurethane foam. W. R. Powers and R. A. Volz (to Scott Paper). U. S. 2,900,278.

Polyvinylpyrrolidone-iodine adducts. S. Siggia (to General Aniline). U. S. 2,900,305.

Anion-exchange resins. J. A. Patterson and I. M. Abrams (to Chemical Process). U. S. 2,900,352.

Composition of poly-1, 1-dihydroxyperfluorobutyl acrylate. L. E. Novy (to United States). U. S. 2,900,355.

Zinc aromatic polyester. R. P. Arndt (to Anaconda Wire). U. S. 2,900,356.

Interpolymers of acrylonitrile, allyl alcohol and styrene. E. C. Chapin and R. F. Smith (to Monsanto). U. S. 2,-900,359.

Polymerization. R. Schmitz-Josten (to Bayer). U. S. 2,900,360.—**End**

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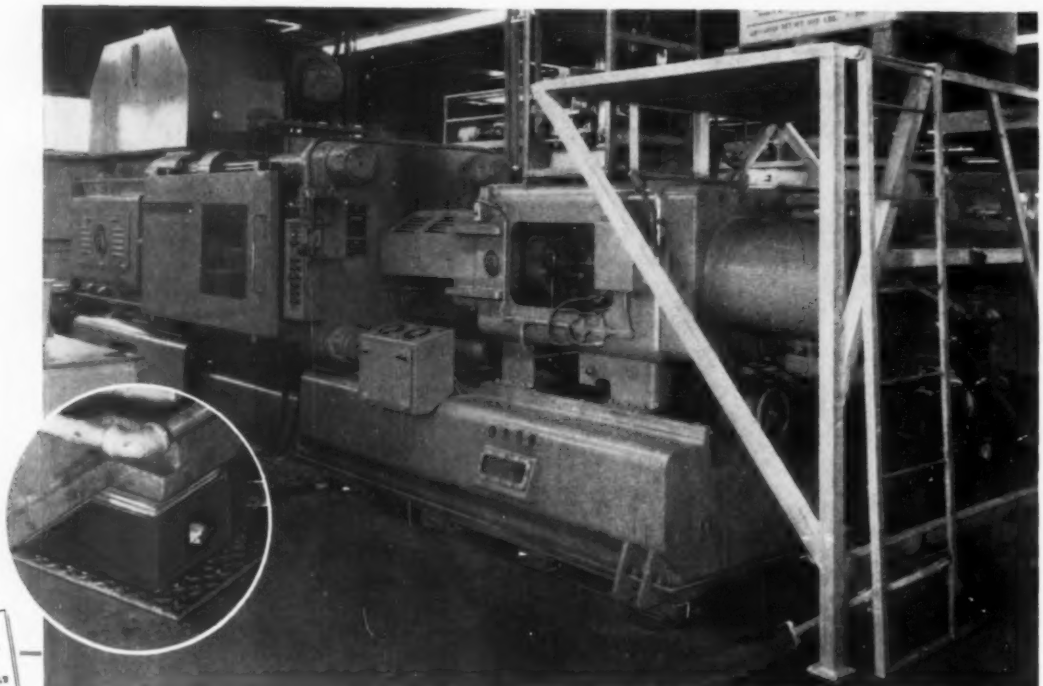

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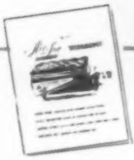

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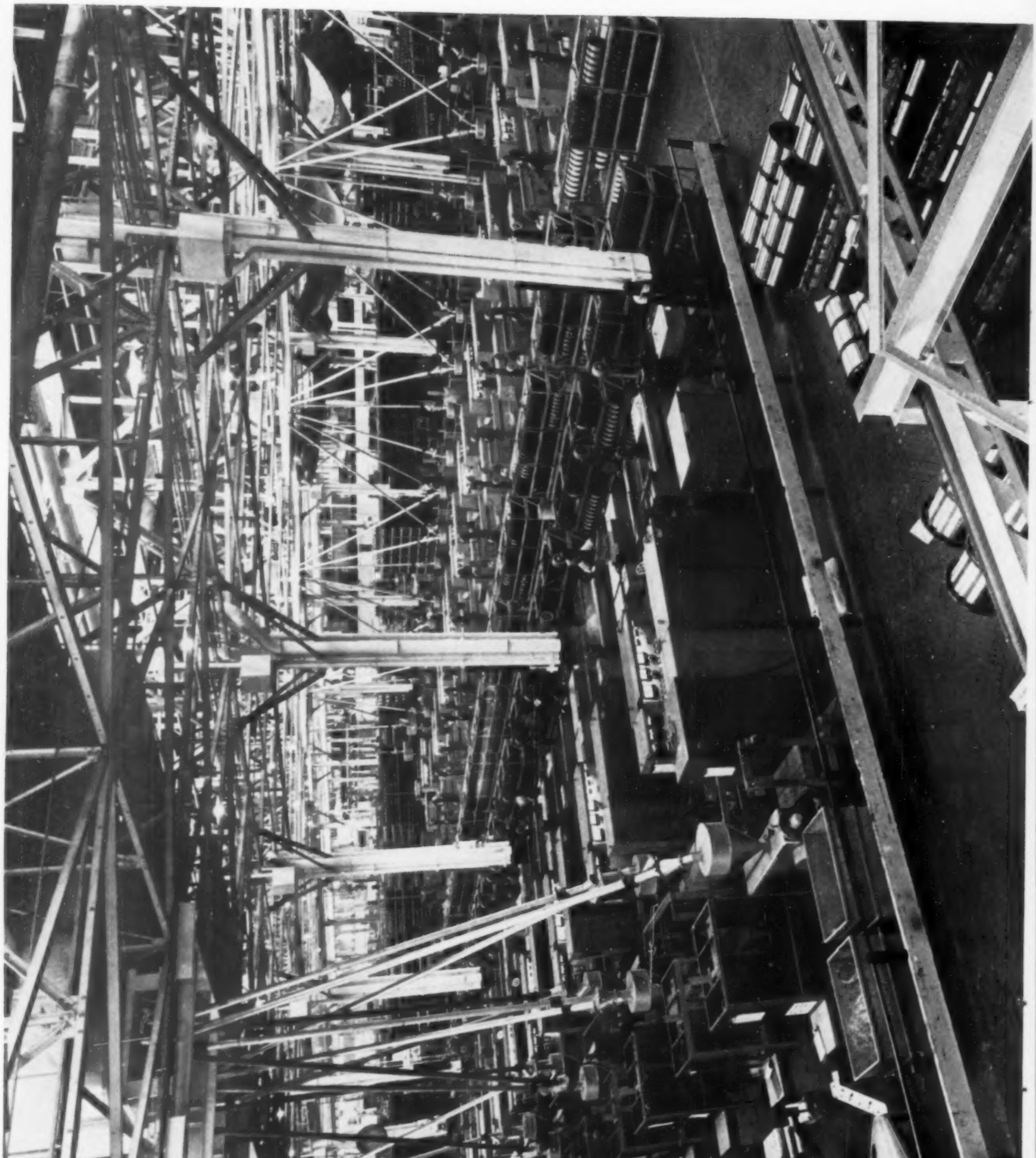

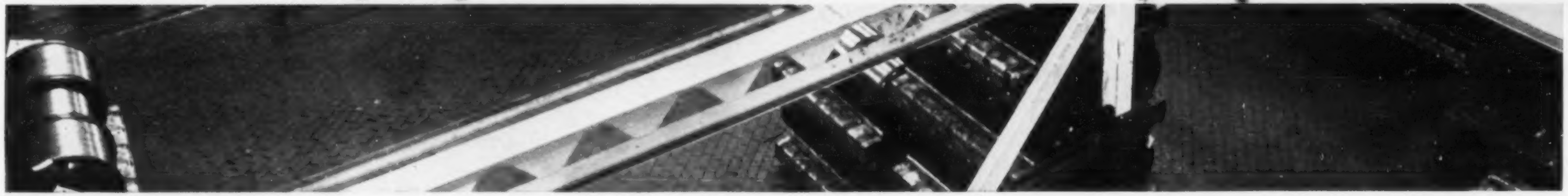

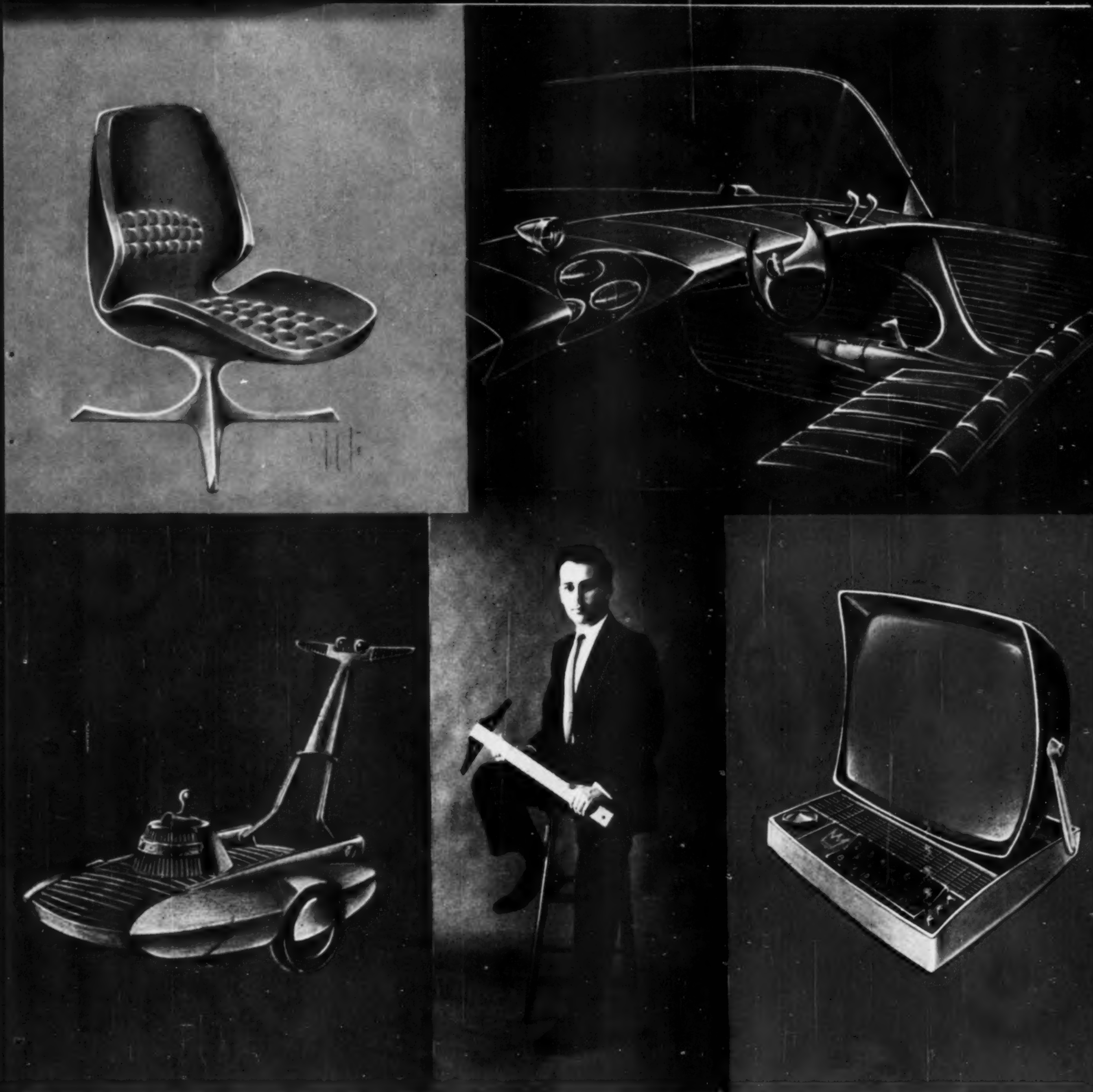

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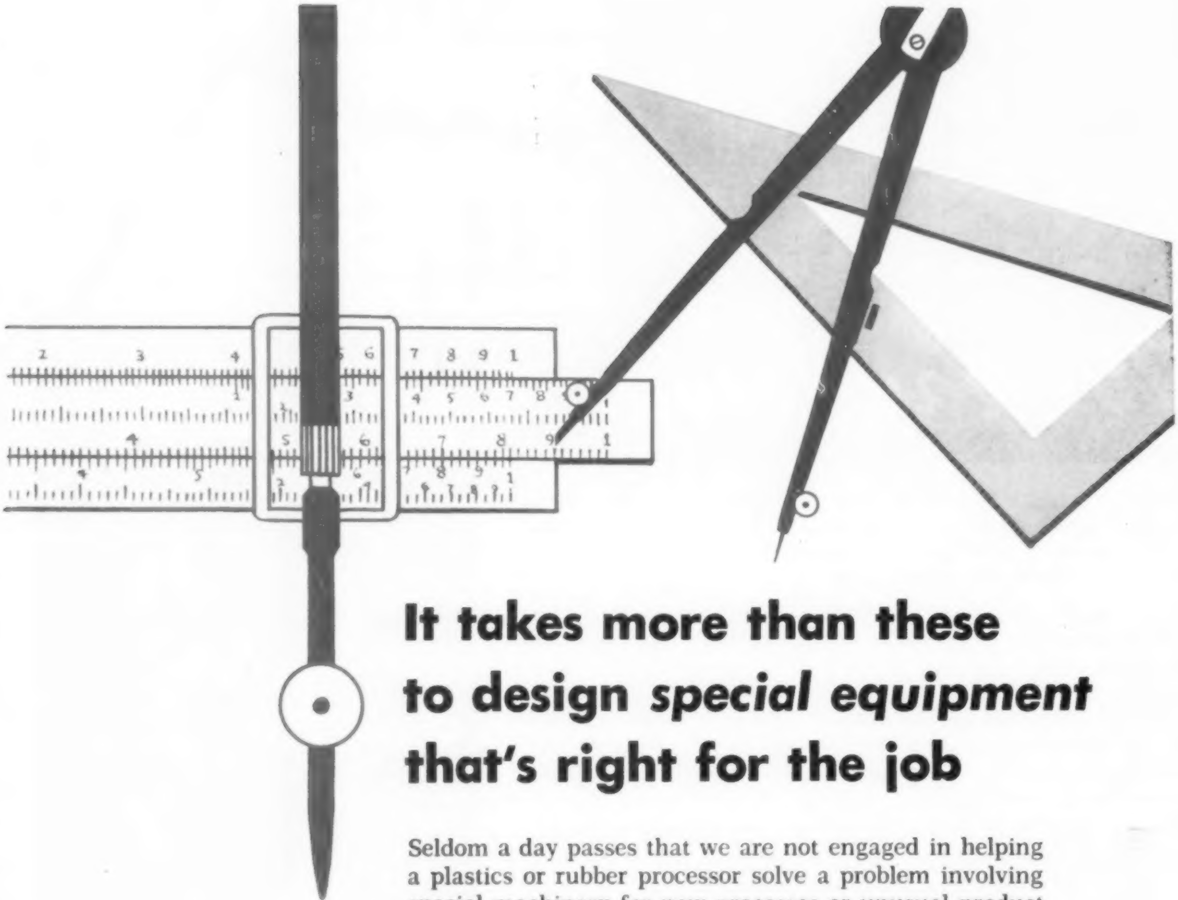

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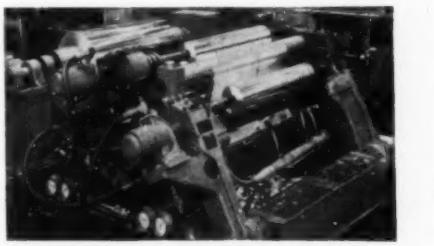
Complete automatic roll control, perfectly integrated from unwind to rewind, is rapidly becoming an absolute essential in all areas of slitting, rewinding, web-fed printing and web-fed processing. Today's high-speed, high-volume production systems cannot tolerate the weaknesses inherent in a piecemeal roll handling arrangement.

TWO NEW MACHINES FROM CAMERON'S FAMOUS LINE OF SLITTER-REWINDERS

CAMERON 620

Versatile! High-Speed! A general purpose slitter-rewinder widely used in processing off-caliper materials, including paper, plastics, foils and laminates. 620 is a popular member of the famous Cameron line of slitters, roll winders, unwinds and web control systems.



CAMERON 650

A fast, rugged Cameron built to meet special requirements. It is used for separating, slitting and rewinding two-ply foil. 650 is shown processing a "double" web of .00035 foil. Speeds up to 2000 fpm. Rewind diameter up to 30". Widths to suit requirements. Can use score-cut, shear-cut, burst-cut or razor-cut slitting.

ASK ABOUT THE CAMERON LEASE PLAN. A LOW, LOW INVESTMENT PUTS PROFIT-BUILDING NEW EQUIPMENT TO WORK FOR YOU RIGHT AWAY.

There are literally hundreds of possible combinations of of tension sensing systems, unwind brakes, edge guides and other web control devices. The problem is to make them work together for integrated roll control. For example, a good tension sensing system is of little value unless its responses actuate a properly fitted brake of the right design and capacity. Sensing and braking are useless if edge guides fail to respond or if the rewind method employed does not suit the material.

To provide equipment that will work in perfect unison to keep a fast-running web under precision control all the way from unwind to rewind is a job for roll handling specialists-engineers who are thoroughly experienced in every phase of the entire unwind-to-rewind process.

HERE IS ONE *SURE* WAY TO GET INTEGRATED AUTOMATIC ROLL CONTROL

Recognizing the growing need for completely integrated automatic roll control Cameron Specialists have established a unique Testing and Development Department. This department is completely equipped for engineered test runs on all types of flexible web materials. Various unwind, rewind, slitting and control elements are teamed to achieve optimum efficiency. You are invited to consult with Cameron Specialists regarding free test runs on your material. Let Cameron help you *stay ahead!* Write or telephone, now.

Cameron Machine Company, Franklin Road, Dover, N. J.

Canada: Cameron Machine Co. of Canada, Ltd., 15 Hatt St., Dundas, Ontario
France: Batignolles-Chatillon, 5 Rue De Monttessuy, Paris (7e) France

CAMERON
a Team of Specialists

53 years devoted exclusively to the design and manufacture of slitting, roll winding, unwind and web control equipment.

The polyethylene film used to package these Hallmark gift papers is produced by Flex-O-Glass, Inc. of Chicago, using "Poly-Eth" 2756, one of the complete family of "Poly-Eth" Polyethylene resins for overwrap.

Now! A Complete Family of Spencer For High-Speed Automatic

In step with the skyrocketing use of polyethylene film for overwrap, Spencer Chemical Company now offers 3 specialized "Poly-Eth" Polyethylene* resins which can all be used in today's high-speed and automatic overwrap machines.

PACKAGING HISTORY was made recently with the development and acceptance of polyethylene film for overwrap.

There is good reason for the immediate popularity of this new overwrap. Polyethylene film offers many advantages not found in cellophane. And polyethylene film costs substantially less than cellophane.

*Spencer Chemical Company markets Spencer "Poly-Eth" Polyethylene, from which polyethylene film is made, Spencer "Poly-Pro" Polypropylene and Spencer Nylon. "Poly-Eth" and "Poly-Pro" are trademarks of Spencer Chemical Company.

Spencer Chemical Company was a pioneer in the development of special resins from which polyethylene film for overwrap is made.

And now, as the widespread use of this new overwrap has produced demands for several specialized types of polyethylene films, Spencer has met these demands by offering a complete "Poly-Eth" family of resins for overwrap. Through Spencer's family of "Poly-Eth" resins a new world of packaging possibilities is opened. (See chart above.)

The polyethylene overwrap that Hallmark, America's largest manufacturer of greeting cards, uses to package gift wrap is illustrative of how each member of Spencer's family of specialized "Poly-Eth" resins is tailor-made to specific overwrap requirements.

America's Growing Name In Chemicals

SPENCER®

See Which "Poly-Eth" Resin Best Suits Your Requirements:

Resin	Melt Index	Density	Characteristics
"Poly-Eth" 2756	6	.928	Produces film with improved tear resistance; gloss; excellent clarity and long shelf life. Ideally suited for chill-roll casting method of extrusion.
"Poly-Eth" 2504	1	.935	Produces film with stiffness; clarity; gloss and sparkle; extra moisture vapor proofness and wide temperature resistance.
"Poly-Eth" 2905	2	.940	Produces film with superior texture and feel; excellent moisture resistance; excellent clarity; toughness; stiffness; wide use temperature range and long shelf life. Designed for the fastest overwrap applications. The highest medium density overwrap resin on the market.

"Poly-Eth" Resins Overwrapping

Seeking a new overwrap with high clarity and gloss, excellent tear resistance and long shelf life, Hallmark chooses a polyethylene film made of "Poly-Eth" 2756 resin to package gift wrap.

The Hallmark gift papers your wife buys this month were printed and packaged early last summer.

Because of this, the overwrap Hallmark uses to package gift wrap must have several special qualities. Primarily, it must be tough, crystal-clear and able to withstand long shelf life.

Hallmark finds all of these qualities in a chill-roll cast polyethylene film produced by Flex-O-Glass, Inc., Chicago, Illinois.

This polyethylene film is made of "Poly-Eth" 2756, one of Spencer Chemical Company's complete family of "Poly-Eth" resins for overwrap.

Among the specialized qualities exhibited by film made of "Poly-Eth" 2756 are: Clarity and gloss found only in the best cellophane. Ideal for use in automatic overwrap machines. Unparalleled shelf life. And a lower cost than cellophane.

The exceptional advantages of polyethylene overwrap have led Hallmark Cards to utilize it in packaging other paper products.

At the present, packages of one-dozen Hallmark Valentine Cards are dressed in printed polyethylene overwrap. And in the near future, Hallmark anticipates packaging many more products in strong, low-cost polyethylene overwrap.

All Easy To Use

Machines now using cellophane may be easily and inexpensively converted for use with polyethylene film made of "Poly-Eth" resins.

Spencer Market Development men will be happy to discuss the application of inexpensive, strong and sparkling polyethylene film to your requirements. For information, contact Spencer Chemical Company at the address below.

Poly-Eth® Polyethylene

Spencer Chemical Company, Dwight Bldg., Kansas City, Missouri

MODERN PLASTICS

The SPECIALTY PHENOLICS

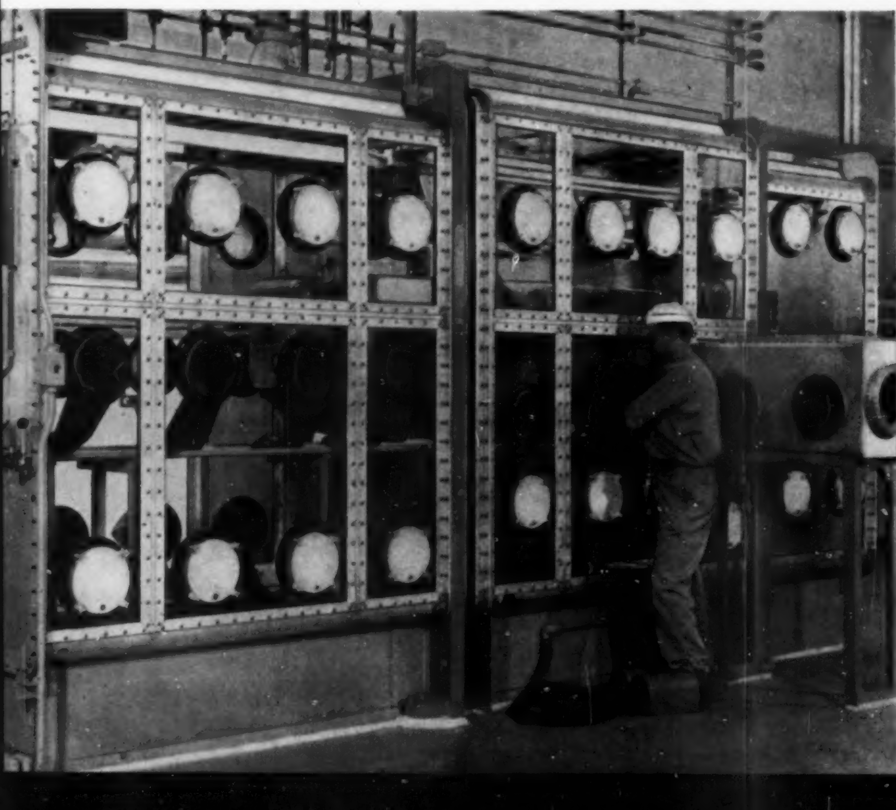
Advances in resin technology, fillers, and processing automation have resulted in materials that can do what others can't

Exactly 50 years after their introduction, phenolics are still behaving as friskily as a young colt. While perhaps a little overlooked in the excitement of numerous new-material announcements, the workhorse of the industry is tackling some of the toughest jobs for materials in industry—and at low cost.

What accounts for this youthful vigor?

Although it is not immediately evident, one of the most probable factors contributing to the continued acceptance and growth of phenolic molding materials is the aggressive approach currently being taken by the material suppliers and molders in the development of special phenolics and fabricating techniques to meet new and demanding requirements.

New compounds and modifications are constantly replacing the old. One company states that changes occur so often that it finds itself replacing nearly all of its identifying compound



RADIOACTIVE PLUTONIUM, being handled safely with rubber gloves through molded phenolic portholes at Argonne National Laboratory. The problem lay in selecting an economical, suitable material for the glove ports when some 1500 at a time were required. Ports had to be tough, leakproof, corrosion and fire resistant, and smooth. Solution was found in selecting medium impact phenolic molding compound. Inset shows close-up of porthole ring and flange.

SPECIALLY formulated fibrous-glass-filled phenolic molding material is used for automotive transmission reverse clutch cone. Use of material eliminated machining of internal slots, provided operation superior to the original metal part, and reduced the cost.

numbers in the space of two or three years. In other cases, numbers are retained and material changes and improvements reflect themselves in the word "new" prefixing the old number.

At the same time, since phenolics have been around for so long, resin technology is well advanced and a wealth of know-how is currently available.

Once fillers in phenolic resins were limited to wood-flour, chopped rags, mica, nut shells, and asbestos. To these have now been added fibrous glass, synthetic flocks (such as nylon), sisal, quartz, ceramic fibers, and other mineral fillers. With this array of new fillers and reinforcing agents, when combined with the many variations and modifications of resins available, the permutations and combinations are for all practical purposes infinite.

All of these factors add up to versatility—without which markets would quickly be lost. Two familiar applications point up this fact: washing machine agitators and automotive distributor caps. As detergents, temperatures, and washing machine designs change, new materials are constantly being developed for agitators. And although one might think a single material would be suitable for all the auto makers' distributor caps, each specifies—and gets—a material specially compounded to meet their individual specification.

Reflecting this versatility are the latest sales figures. Far from having been superseded by

HUNDREDS of these receptacle blocks form the heart of a new modular computer system. A tailor-made impact phenolic with good flow is used to mold them. Note dozens of tiny holes formed by fragile mold pins (left). At right is other side of the part, showing complexity of molding.

the many newcomers, phenolics sales are standing up nicely. From a low of 170 million lb. in 1958, phenolics are expected to top the 200 million mark by the end of 1959, which is a 16% increase.

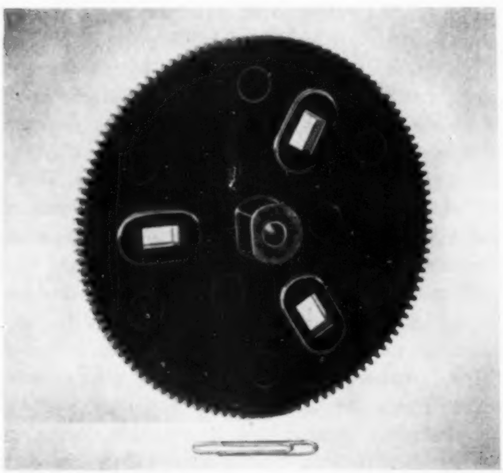
Trends in phenolics

In order to meet the molder's needs, compound development is producing materials with faster cures, easier flow and moldability, preformability, and suitability for automatic operations. Result: production costs have been going down.

At the same time, the designer and user are looking for greater physical strength (impact, flexural, tensile), better heat resistance, increased arc resistance, better wear properties, dimensional stability, better chemical resistance and a host of other properties.

Building all of these properties into a single all-purpose material is practically impossible. However, there are very few applications that demand the presence of all these properties in the same material. In actual practice, the versatility of phenolics allows the producer to juggle the formulation to emphasize any one of these characteristics—provided sacrifices in others can be made. This is the area where the phenolic compounder rolls up his sleeves and goes to work. The key word is "balance"—a balance of properties in a specially formulated material tailored to meet a specific application.

To illustrate what can be done when the designer is not satisfied to "make do" with what is listed in the catalog and digs deeper by calling in the compounder and molder to help him develop a material that will better match his needs, let's look at the following examples of how specially developed materials can solve knotty industrial design problems.



SPECIAL nylon-flock filled phenolics, such as used in electric typewriter gears, combine the dimensional stability of phenolics with the abrasion resistance of nylon for precision parts.

MOTOR PROTECTOR PARTS molded of specialty phenolic are used in jet airplanes, will withstand 500°F. continuously in this use.

An auto manufacturer was using aluminum for a part known as a reverse clutch cone which is an integral part of an automatic transmission system and transmits full engine power to the rear wheels of one of the heaviest passenger cars. Close tolerances had to be held on the part which required the machining of about 70 slots around the internal circumference of the part. In actual service the aluminum failed by galling, showing excessive wear, which interfered with the proper operation of the automatic transmission system. To solve this particular problem, it was necessary to develop a special glass-fiber-filled impact phenolic molding compound.

Results speak for themselves. After much testing, this material has been found to be the best material for the job. The part is now produced to tolerance with the slots molded in, has excellent dimensional stability and wear resistance and has resulted in an overall cost saving of one-third over the metal.

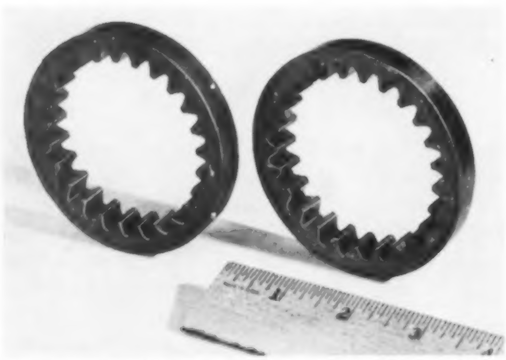
The same glass-fiber-filled material proved to be just the ticket for another high tolerance part in the automatic, automotive, transmission system requiring dimensional stability, namely

an oil pump gear. Besides outwearing its metal counterpart by a factor of about three to one, savings in the cost of the part amounted to about two-thirds that of the original cost.

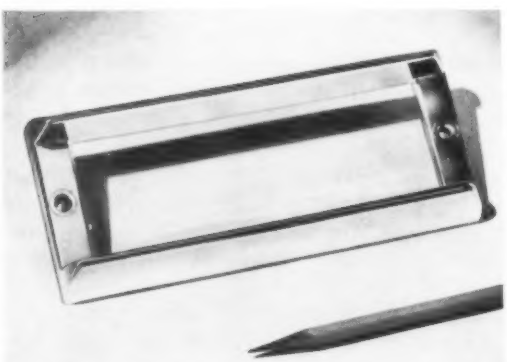
When the automotive designers ran into trouble with nylon gears in a motorized antenna system, another special phenolic compound came to the rescue. Although the wear resistance of the nylon gears was excellent, cold flow of this thermoplastic proved to be more than this application could tolerate. The answer to this problem proved to be a happy wedding of two plastic materials—a nylon flock filled phenolic resin. While retaining the good abrasion resistance of nylon and eliminating the cold flow of straight nylon, the use of the cross-linked phenolic has virtually eliminated another headache.

Although these materials are considerably more expensive than general purpose phenolics, priced between 55¢ and 60¢ per pound, the overall production economies resulting from their use have resulted in relatively substantial savings.

The same story applies to other applications in other fields. Take the new modular type computer systems. The heart of this system consists of hundreds of modular units, each carrying various circuits, which can be plugged in or pulled out as needed for various problems. The base receptacle block of each modular unit contains over 100 tiny holes through which fine contacts pass and is molded of a special phenolic material developed for the application. The problem here consisted of getting a material having sufficient impact strength to withstand the handling during assembly operations. It also required the proper flow properties so that the delicate mold pins forming the holes in the block would not be distorted during the transfer molding operation. Dimensional stability and the ability to hold close tolerances were also musts. A cellulose fiber-filled specially formulated impact phenolic was the answer.



OIL PUMP GEARS use phenolics with glass (left) or asbestos (right) fiber fillers. Problem was to maintain dimensional stability and close tolerances on the thickness dimension. Use of phenolics has prolonged the wear and cut the cost of former metal gear by two-thirds.



METALLIZED phenolics make attractive car dome light frame, allow designer to combine decorative advantages of chrome with heat resistance and dimensional stability—at low cost.

Another part in the business machine field which has been successfully engineered in a custom made phenolic is an electric typewriter gear. This part is an excellent example of the cooperation at the beck and call of designers and engineers from the material suppliers and molders. It took approximately three years to develop and prove this part before the proper mixed fiber reinforcement was found for the right resin to produce impact strength, good abrasion resistance, and lack of abrasiveness on mating parts as well as dimensional stability—all in one material.

Temperature resistance is often a problem in some applications. A good example of this was the need for an electrical motor protector device which would withstand the high temperatures encountered around jet engines in aircraft for extended periods of time. In meeting this need the phenolic material suppliers came up with another tailor-made resin. Using the proper resin formulation in combination with an asbestos filler, a phenolic molding material was developed which will withstand 500° F. for prolonged periods of time without a significant change in proper- **(To page 204)**

POLYPROPYLENE upgrades housewares

Better impact and heat resistance promise good market for PP housewares—despite a higher price than PE and polystyrene equivalents

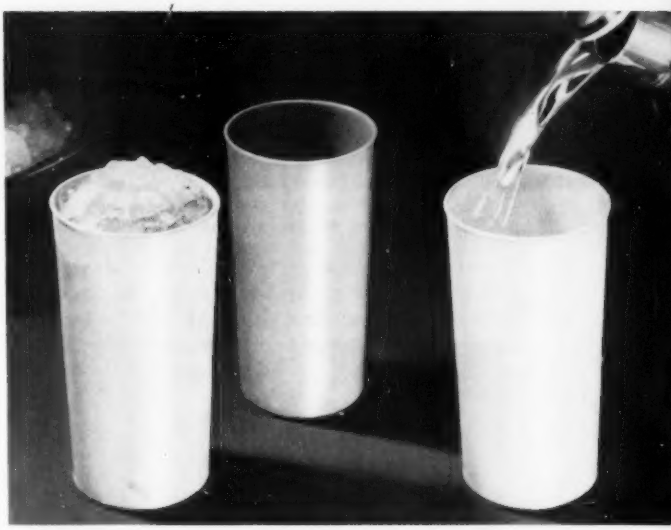
GOOD IMPACT resistance is shown by crisper that remains undamaged under mallet blows.

Successful marketing experience with polypropylene drinking tumblers and food crispers, injection molded by Associated Plastic Div., Commercial Plastics Co., Chicago, Ill. indicates that the new resin, despite its higher cost as compared to customary household thermoplastics such as styrene and polyethylene, may be expected to make a strong bid for housewares applications in which high impact and temperature resistance are important factors.

Both of the new items are produced of Hercules Pro-fax material on a 24-oz. Reed-Prentice injection machine. Two molds—one for the cover and one for the base—are used for the crisper; the 14-oz. tumblers are made in an eight-cavity mold. Parts are center gated.

Both items carry a printed guarantee under which they will be replaced free of charge if they fail under normal use conditions within one year. According to the company, the crisper is not adversely affected by boiling water or home freezer temperatures and will not break or crack. The rugged lower section may also be used as a dishpan, if desired. Over-all dimensions are 14 by 9½ by 4½ inches.

Retailing at $2.98, the same basic crisper is also available at $1.98 molded of regular transparent styrene. The same tools are used for both crispers. With polypropylene, a slower molding cycle is required than when the styrene crispers are being run. Thus, the price differential reflects not only the higher cost of polypropylene (43¢ per lb. vs. 20½¢ for transparent styrene) but also higher production costs, including coloring. Associated does its own coloring of the polypropylene material for these items, adding dry color to the basic resin and running the material through an extruder to obtain complete color dispersion.



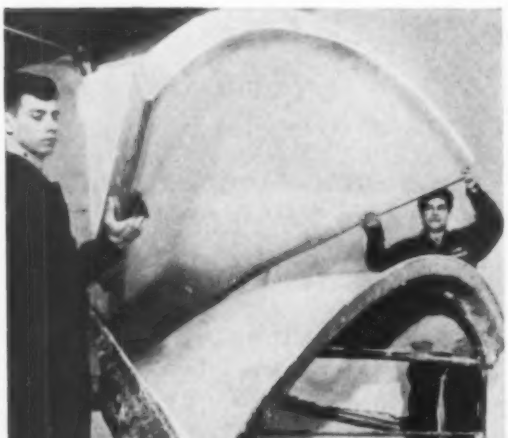
NEITHER ICE nor boiling water have deleterious effect on polypropylene tumblers.

The new tumblers retail at 25¢ each. They were formerly molded of translucent regular styrene in several colors, but are now made only in polypropylene. The 14-oz. size is especially useful for hot and cold tall drinks.

These polypropylene housewares are said to have very moderate dust attraction, as compared to regular styrene or polyethylene. Also, the surface of the material is relatively hard, making it an easy matter to remove any dust without smudging the item.—End

U.S. PAVILION IN MOSCOW

AERIAL VIEW of 47-umbrella reinforced plastics cluster erected in Moscow's Sokolnike Park. Exhibition hall was constructed on the site from components molded in the United States.



SECTION OF RP UMBRELLA is removed from reinforced plastics mold on which it was produced by contact method.

RUSSIAN WORKMAN assembles completed canopies to metal spider. Six-shell canopies are bolted along edge ribs to form complete unit.

Constructed of reinforced plastics "umbrellas," building pioneers new architectural concept with far-reaching economic implications

THE COVER: Translucent columns and canopies provide diffused illumination in reinforced plastics pavilion at night.

A million Muscovites attended the American Exhibition in Sokolniki Park, Moscow, U. S. S. R., last summer to watch fashion shows and square dances under a spectacular reinforced plastics pavilion.

The building would have been just as exciting if erected on Main St., U. S. A., because it involved daring new concepts in design, engineering, and construction—concepts likely to affect the use of plastics in the building field for years to come.

Ninety reinforced plastics "umbrellas" were assembled in clusters of 20, 47, and 23 to make up the pavilion. A total of 630 premolded parts made up the structure which resembles long-stemmed 16-ft. diameter trumpet lilies, each with six translucent petals linked to form a roof. The columns taper from small (6-in. diameter) at the base to a strongly-flared top (36-in. diameter) 16 ft. above the base, with the sweep of the flare carrying upward continuously to a total height of 20 ft. into six doubly-curved thin shells forming a canopy, hexagonal in plan and 16 ft. across. The hexagons were clustered in various arrangements to form three pavilions.

Shells were made only 1/16 in. thick to provide maximum translucence, but the doubly-curved shape made this adequate for the 60-m.p.h. winds for which the units were designed. Columns and ribs were 3/16 to 1/4 in. thick. Because the pavilions were to be taken down after the exhibition closed, they were not designed for winter conditions.

Architectural design of the umbrellas was carried out by the office of George Nelson, New York, N.Y., which also was responsible for the overall design direction of the entire exhibition, including displays inside the dome and the aluminum-and-glass pavilion. Engineering consultant for the job was Albert G. H. Dietz, Professor of Building Engineering and Construction, Massachusetts Institute of Technology, the man who engineered the Monsanto "House

FULLY ASSEMBLED CANOPY is bolted to top of tapering reinforced plastics column. Joint is first caulked for watertightness.

COMPLETED UMBRELLA ready to be hoisted into place by crane, alongside several others already installed. Roof will be continuous.

of the Future" and the U. S. pavilion at last year's Brussels Fair. Lunn Laminates Inc., Huntington Station, N. Y., molded and fabricated the units. Jack Parris of Lydick Roofing Co., Fort Worth, Texas, was in general charge of construction. He was assisted by Boris Nepo of Reynolds-Feal Co., Milan, Italy. Roy Berg, Senior Project Engineer at Lunn Laminates, the molder, was on the job for a major portion of the time. Representing George Nelson were John Hall, Philip George, and Rodney Hatenaka. Prof. Frank Heger of M.I.T. was associated with engineering design and testing. Engineer in general charge of the Russian operations was A. Abramow.

CAST CIRCULAR concrete sump at base of column is for drainage. Lines run from sump to dry well, could be used for irrigation.

How parts were produced

All parts were molded of Owens-Corning Fiberglas and Ferro fibrous glass mat with Hetron 92 flame resistant polyester resin by hand layup on glass-reinforced polyester molds made from wood patterns. In the molding, woven roving was employed in a small area in each of the stiffening ribs of the canopies to improve bolt-bearing capacity.

Columns were molded in three identical longitudinal pieces which were then placed in a bonding jig, cemented with an epoxy adhesive, drilled, and bolts installed. Canopies were molded in six identical doubly-curved sections with integral edge ribs and were shipped nested for assembling on the site.

When the first parts came off the mold, and the first assemblies were erected at the Lunn plant at Huntington Station, it was imperative that the daring design and engineering concept be thoroughly tested before parts could be shipped to Moscow. The test devised involved the use of three twin-engine static airplanes on the runway at the Mitchell Air Force Base, subjecting the columns to constant hurricane treatment of winds up to 60 m.p.h. (For additional reference, see "Moscow pavilion units tested," MPl, May 1959, p. 238.)

Manufacture, factory assembling, and testing being complete, the parts of the structure were shipped to Moscow. Site preparation consisted largely of leveling by power excavators and bulldozers as necessary. Foundations consisted of precast concrete footings for the individual umbrellas. These were 1 meter square and ¾ meter deep and provided a wide margin of weight against uplift and rocking under the expected summertime wind conditions. Square holes were left in the centers of the blocks to receive the anchor bolts which were hooked around steel bars cast into the blocks. After careful centering and leveling, the anchor bolts were bedded in fresh concrete cast into the square holes.

Procedure for installing the foundations was to drop the precast footings, by means of tractor-mounted cranes, into pre-dug holes, level and center the footings as accurately as possible, and then install the anchor bolts, bringing them to within ¼ in. of true center horizontally and 1/16 in. of true level vertically. It took some persuasion to convince some of the Russian foremen that this had to be done with transit-and-tape accuracy rather than with centering sticks only, but it was finally accomplished. Such accuracy was essential if the prefabricated umbrellas were to fit.

Assembly of canopies

While the sites were being prepared, the canopies were put together at an assembly area nearby. Assembly consisted of bolting the six-shell units together along their edge ribs and bolting the steel spider which provided the necessary continuity across the center of the canopy. (Spiders could have been fabricated of reinforced plastics but the inordinately tight fabrication schedule dictated the use of steel, which could be fabricated in another shop.)

Once the footings were in place, erection of the umbrellas went ahead smoothly and quickly. Canopies and columns were trucked from the assembly area to the final site. The crane lifted a canopy to a height of about 6 ft. from the ground and swung into a roughly vertical position; next a bead (To page 208)

How Hoover uses SEVEN PLASTICS in its new electric floor washer

EFFICIENT AND COLORFUL floor cleaning appliance incorporates 38 different plastics parts, would have been impossible to produce without the wide range of plastics available to meet exacting engineering requirements.

Economists claim that 50% of our present industrial labor force is making products that didn't exist 50 years ago, that 20% is making items that were not on the market 20 years ago . . . and plastics are playing a significant part in this continuing product revolution. In many cases a product couldn't be made if we didn't have plastics—and a wide variety of plastics.

Typical of the latter case is the Electric Floor Washer recently introduced by The Hoover Co., North Canton, Ohio. It is a brand-new appliance, the like of which has never been offered before; and it is made up of 38 different plastics parts, four metal parts, and a motor. Total weight of the appliance is 11½ lb.; metal weight, exclusive of motor, is 2.91 lb.; plastics parts weigh 5.08 pounds.

The need for the new appliance arose out of the increased usage of vinyl and similar hard-surface floorings; its unique action was made possible by the new low-suds detergents; its lightweight efficiency is the result of good engineering and the use of carefully selected plastics.

How it operates

Key component of the floor washer is the ABS (acrylonitrile-butadiene-styrene) tank system. It holds and dispenses the clear water-detergent mixture onto the floor and contains a polyethylene vacuum bag which receives the dirty water as the floor is washed. To start the operation, the tank is lifted off the assembly by its handle, the polyethylene vacuum bag is lifted

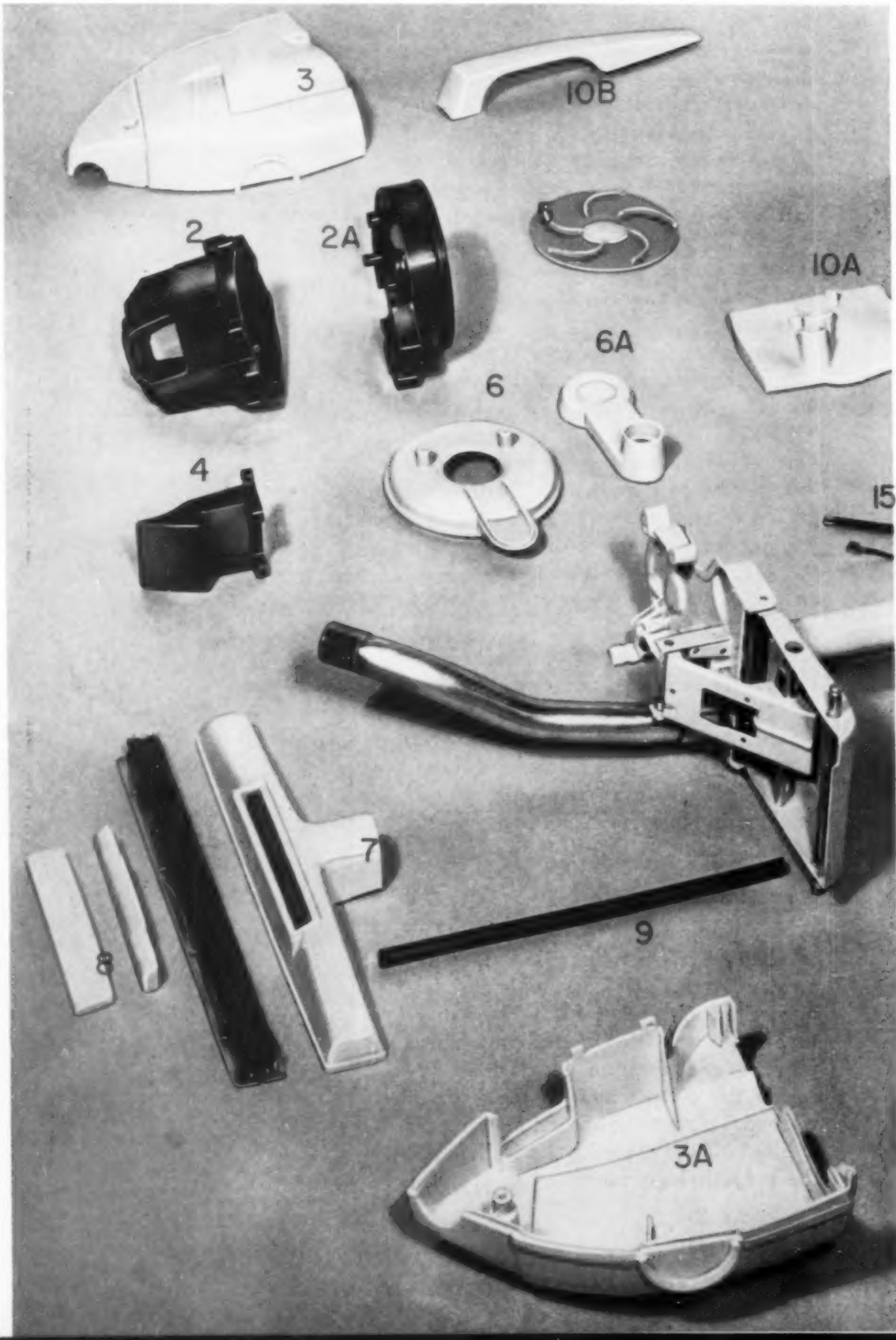
out of the tank, the tank is filled with water up to the "full" mark, two level tablespoons of low-sudsing cleanser are added to the water, the empty PE bag is dropped back in, its collar fitting tightly, and the tank locked into place.

The washer is switched on and off by stepping on a large foot pad placed between the wheels. All operations are controlled by a trigger and pushbutton located on the handle. The trigger is squeezed to start the clean water flow and released to start the scrubbing cycle. The push button starts the vacuum drying mechanism which pumps the dirty water into the plastic bag in the tank. After use the bag is emptied and rinsed out, and the tank is emptied.

The whole operation on an average kitchen floor takes only minutes, opening up an entirely new era in floor care.

Why so much plastics usage in this new floor scrubber? First, high impact strength was

PARTS OF NEW FLOOR WASHER: 1) metal assembly skeleton; 2) motor casing; 2a) motor plate; 3) and 3a) motor housing; 4) motor exhaust; 5) air deflector; 6) fan housing; 6a) air duct; 7) nozzle; 8) nozzle cap; 9) discharge tube; 10) tank; 10a) tank bottom; 10b) tank handle; 11) separator base; 11a) separator cap; 11b) separator base closure plate; 11c) separator cap closure plate; 11d) air valve, hinged on piece; 12) separator tube; 13) control housing handle; 14) handle knob; 15) lead wire protector; 16) wheel carriage foot pad; 17, 17a) carriage wheels; 18) dirty-water bag; 18a) bag ring; 18b) bag closure; 19) cord and plug.



needed because the product may be abused. Second, since hot water is used, heat resistance is a must. Third, chemicals such as pine oils must be resisted. Fourth, dimensional stability must be maintained. Fifth, many parts were designed for solvent cement assembly with no mechanical fastening. And sixth, light colors were wanted, especially the primrose yellow selected by color consultant Faber Birren.

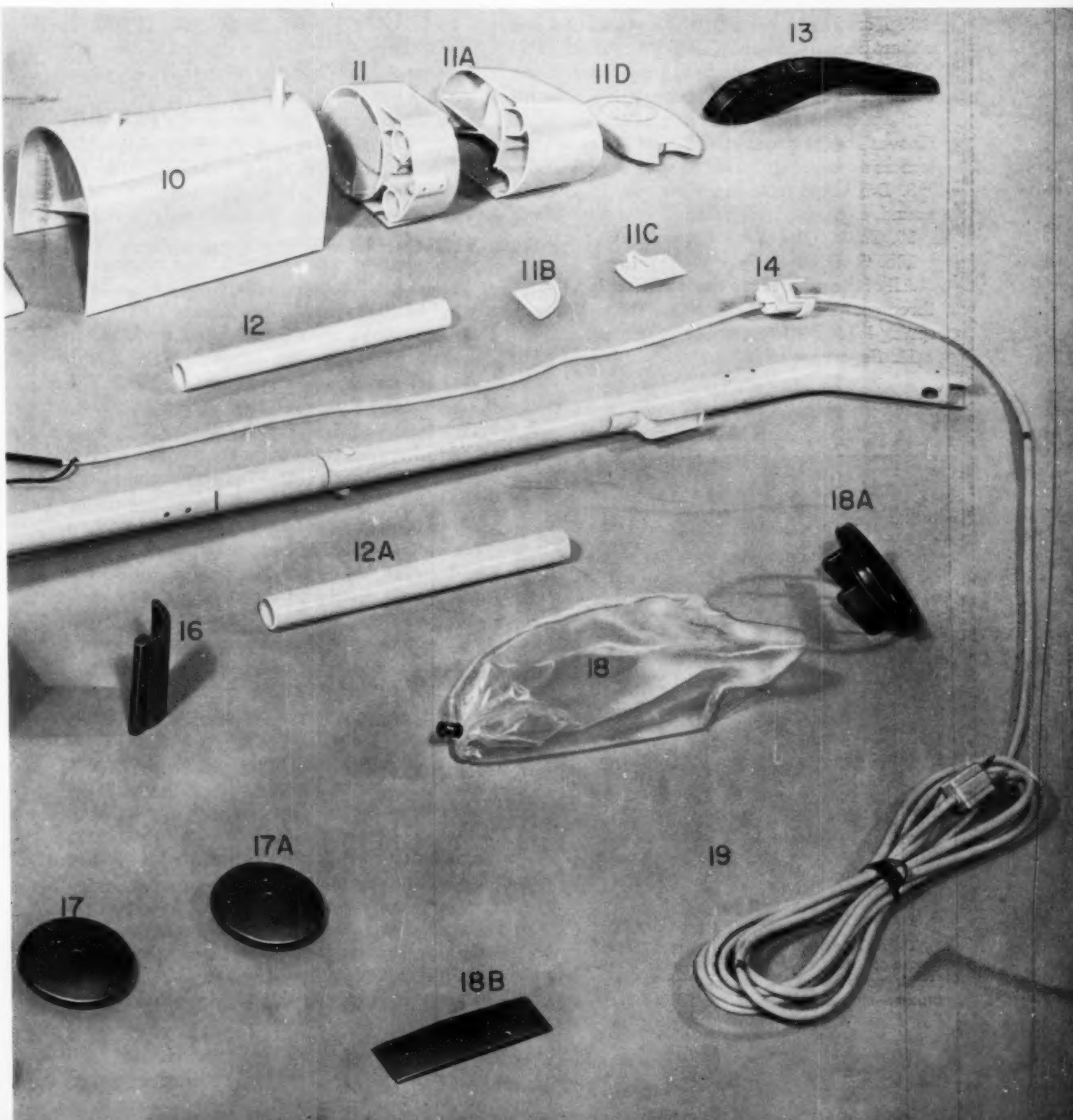
Referring to the exploded view below, and the part numbers, here are the materials that were used, and how:

1. *Metal assembly skeleton.* Steel tube, steel stampings and aluminum die casting.

2. *Motor casing.* General-purpose phenolic, Bakelite BMMD-7000.

2a. *Motor plate.* Special phenolic for water resistance. Plenco 507.

All the phenolic parts are molded on Baker automatics with powder preheated by LaRose



high-frequency feeders. No inserts are used because assembly is by cementing and self-tapping screws.

3. and 3a. *Motor housing.* Special high-density polyethylene material, self-extinguishing, Grex C-1008 in primrose yellow. A close-up view of the housing is shown below.

4. *Motor exhaust.* Grex C-1008 in black.

5. *Air deflector.* Impact-resistant ABS polymer, Cycolac T, natural color.

6. *Fan housing.* Cycolac T, primrose yellow.

6a. *Air duct.* Cycolac T, primrose yellow. These parts are cemented together.

7. *Nozzle.* Cycolac T, primrose yellow.

8. *Nozzle cap.* Special polyethylene. Can use either Union Carbide's DYNF or Tenite PE-808. Just above the nozzle cap is a small block of material called a nozzle cake. It is a defoaming agent bonded with a plastic, made to Hoover's own specification, just in case customers erroneously use high-suds detergents.

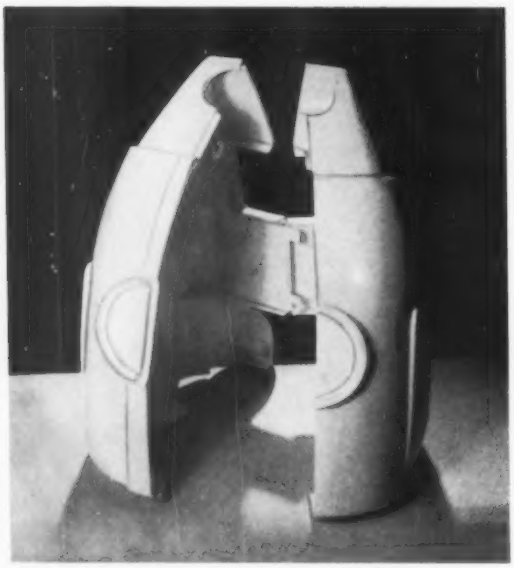
9. *Discharge tube.* Hoover's own PVC compound, extruded. (HPVC).

10. *Tank.* 10a. *Tank bottom.*

10b. *Tank handle.*

All of these parts are made of Cycolac T, first three components cemented together. Valve is spring-loaded into assembly.

11. *Separator base.*



TWO-PART motor housing has tongue-and-groove construction for ease of assembly. To assemble, parts are put in jig, a proprietary cement brushed onto tongues, and unit held till set.

11a. *Separator cap.*

11b. *Separator base closure plate.*

11c. *Separator cap closure plate.*

11d. *Air valve, hinged on piece.*

All Cycolac T, primrose yellow. These parts are cemented into one unit.

12. *Separator tube.* Primrose yellow polyethylene, extruded. Three are specified: Spencer 2406, Alathon 16NC10, Tenite PE 872 E.

13. *Control housing handle.* Black Styron 440. (Dow Chemical).

14. *Handle knob.* HPVC, yellow.

15. *Lead wire protector.* Turbotherm vinyl extrusion from Wm. Brandt & Co.

16. *Wheel carriage foot pad.* Red HPVC, extruded, riveted to assembly.

17. and 17a. *Carriage wheels.* Black Cycolac T.

18. *Dirty-water bag.* Monsanto's PE 706.

18a. *Bag ring.* Marlex 6000 PE, black, molded.

18b. *Bag closure.* Mylar tape holds bag fastener in place.

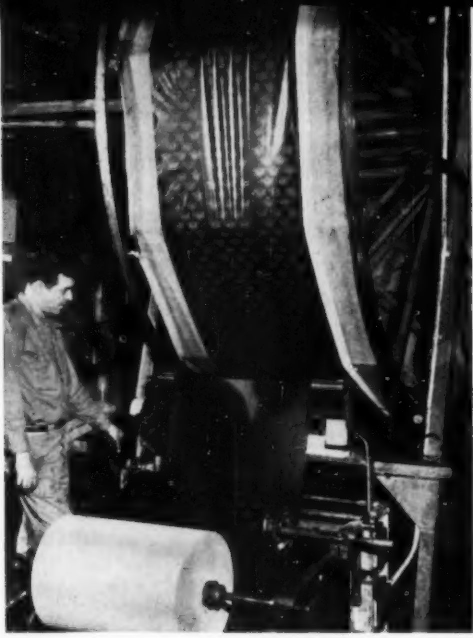
19. *Cord and plug.* Hoover's polyvinyl chloride molded and extruded.

In addition, not shown in our photograph, there are two tiny wheel lock washers made of vinyl by Shakeproof Div., Illinois Tool Works; also not shown are a handle plug, made of general-purpose phenolic (Durez 792); a tube connector and tank valve, extruded HPVC; a handle control release, Red Styron 440; and a tank latch pad, HPVC yellow.

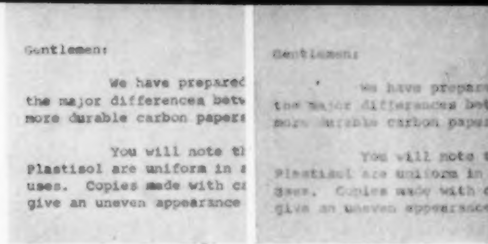
All thermoplastics parts are molded on Watson-Stillman and Reed-Prentice machines, and small parts are usually molded on automatics. An interesting technique was developed for cementing the ABS components: small amounts of Cycolac resin were dissolved in the solvent to improve bond-surface contact and to speed cementing cycle.

The Hoover design and manufacturing philosophy is a major factor in the development of this and all other Hoover products. First, lead time is cut by using a project team consisting of designers, product engineers, tool designers, and plant engineers. Thus, when all components are available, the assembly line with its jigs and tools is ready for them. Second, tooling is always the best available. Even single-cavity test molds are steel. Third, every product is use-tested before shipment.

Our thanks to Don C. Krammes, Project Engineer; Frank Martin, Plastics Engineer; R. W. Gillman, Public Relations Manager; and Robert Miller, Plant Photographer, for their cooperation in preparing this article.—End



ROLL of plastisol-based duplicating medium is wound on 29-ft. diameter "Ferris wheel" and 36-ft. lengths are cut off. Lengths are then fed to another unit, which cuts them to appropriate size. Use of wheel permits cutting more than one layer at a time—evenly.



Gentlemen:

We have prepared
the major differences betw
more durable carbon papers

You will note th
Plastisol are uniform in a
uses. Copies made with ca
give an uneven appearance

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We have prepare
the major differences bet
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You will note t
Plastisol are uniform in
uses. Copies made with c
give an uneven appearance

FIRST COPY made with Plastisol carbon (left), and sixtieth. Note small extent of variation.

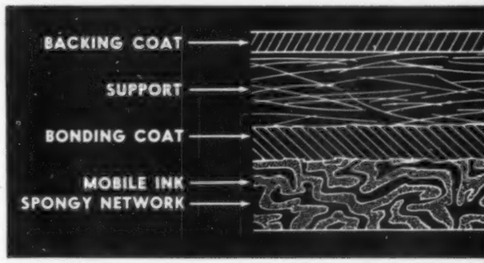


DIAGRAM showing structure of new "carbon paper."

Smudgeproof "carbon" copies

New duplicating paper, based on vinyl copolymer, is expected to save American business millions of dollars per year

In what has been called the first major technical advance in the 60-year history of the carbon paper industry, Columbia Ribbon & Carbon Mfg. Co. Inc., Glen Cove, N. Y., has introduced a carbon paper that depends for its performance on the use of Union Carbide's VYHH vinyl copolymer. The new paper has been tradenamed Plastisol.

Unlike conventional carbon paper, which transfers a carbon coating from one paper to the surface of the other, Plastisol contains a pigmented fluid that inks the paper, leaving a permanent, smudgeproof image. According to the company, a single sheet can be used satisfactorily about 60 times, with little apparent change between first and last usage.

The potential annual market for this type of product has been estimated at $40 to $50 million, when special usages are included. This represents about half the carbon paper purchased annually by American business. Price of the new paper is $4.75 per hundred, which compares to $5 for conventional carbon.

Because of the fact that the paper is said to be good for 60 separate uses, savings to the user are claimed to be considerable. Companies using the new product are expected to save about one-half of what they are now spending on carbon paper. For large users, this could run into thousands of dollars annually.

As shown in the accompanying diagram, the new paper is composed of a series of sponge-like cells filled with a pigmented liquid. When struck by a type bar, a certain amount of liquid ink is released, leaving an image on the paper. When pressure is released, ink from other areas flows in to refill the empty cells. Thus, ink distribution is comparatively uniform.

The liquid ink phase of the formulation is stirred into the vinyl-solvent solution under controlled conditions so as to form a type of plastisol, after which the formulation is then ready for coating. The coating is done on a special machine where a film is applied to the paper which has previously been treated with a bonding coat. The coated web of paper receives an application of air flow at specific temperatures causing an evaporation of solvent in the plastisol. During the coating process the plastisol is dried and then wound onto rolls that are then back-printed and surfaced. At the same time, the printed side is coated with a vinyl backing to stabilize the carbon against curl and provide a non-slip feature.—End

HIGH-DENSITY POLYETHYLENE parts, of which these four animals were assembled, are interchangeable, can be combined in approximately 14 million different ways.

DIZZY DO-IT-YOURSELF ZOO

Using high-density PE, big plastics model kit maker uses two molds to make parts for 14,000,000 different crazy creatures

When a company making plastic scale model hobby kits of polystyrene for years suddenly turns to high-density polyethylene for a new product in its line . . .

When that company is Revell Inc., Venice, Calif., probably the nation's largest producer of such kits . . .

When the product is Dr. Seuss' zoo, reportedly the fastest selling single PE toy since the days of the hoola hoop . . .

Then the news has industry-wide implications. It represents more than a simple addition to a product line. It constitutes the opening of an entirely new and expanding market for high-density material, a market that might be described as composed of "put-together-take-apart" products.

The new "zoo" is a toy rather than a model kit—although it resembles the latter in many respects. Each zoo contains close to 100 molded pieces which can be snapped together to form three out-of-this-world-looking animals. But the parts are designed to be interchangeable . . . and from these basic animals over 14 million different creatures can be assembled. Retail prices range from $1.49 for one of the animals to $3.98 for a kit containing three.

Why high-density PE

Despite the fact that Revell's overwhelming experience has been with polystyrene and, despite the fact that the company had never done anything in polyethylene, it chose the high-density material for this application. What were the reasons for that decision?

The fact that this toy is to be snapped to-

gether and pulled apart uncountable times called for a material that would make the snaps relatively easy but at the same time permit production of the female part of the snap-together fit that would not spread too much when in actual use.

Also, since this was a toy that was going into the hands of youngsters ranging from a very young age, the product had to have just the right degree of "soft" hardness, be unbreakable and pleasant to the touch, as well as integrally colored.

Of all the materials considered, high-density PE met these requirements best and most economically. The particular resin chosen was Grex, a product of W. R. Grace & Co., Polymer Chemicals Div.

How kit is made

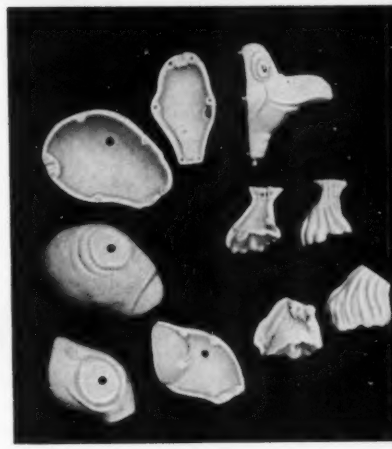
Two molds were developed for this application. One is a conventional mold which produces bodies and legs, as well as the head of one of the animals. It has 34 cavities and was designed to include side action slides and turn pins enabling the mold to run in three alternate colors. This mold is used in a 12-oz. standard Impco machine.

The second mold produces parts in three assorted colors at the same shot. It has also side action slide design; has 54 cavities; and is run in a special Impco machine built to Revell specifications. The machine has a 4-oz. center cylinder with two 3¼-oz. outboards.

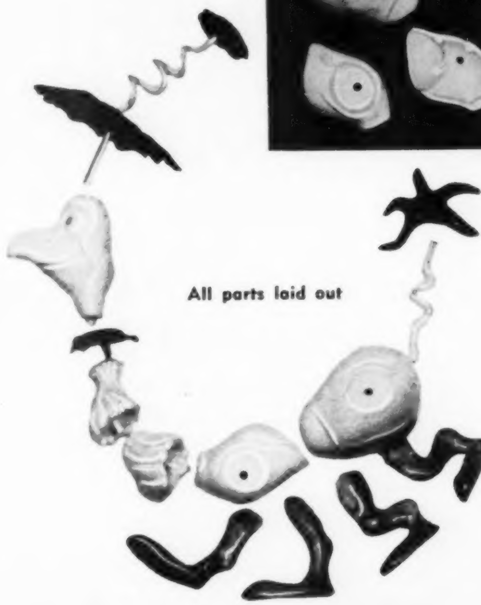
Both injection machines have refrigerated units for water temperature control. These two molds enable Revell to produce four different colors during the same pro- (To page 206)

HOW PARTS COMBINE TO MAKE ONE ANIMAL

Two-part head



Head, body, and neck pieces



All parts laid out

MALE (left) and female halves of 33-cavity mold produce legs, body, and head of one animal. The mold is designed to include side action slides and turn pins.

BLOW MOLDING

Photo, Celanese Plastics Co.

INSECTICIDE TANK is blown with integral metal ring insert (in color) in mouth of tank. Insert is placed around air mandrel and plastic is pulled over it during blowing operation.

How to get into it,

what you can get out of it

Photo, Union Carbide Plastics Co.

EIGHT MULTI-COLORED SHELLS, blow molded of a mixture of high- and low-density polyethylene, are joined together by elastic bands to make an unusual pull toy that raises and lowers itself as it moves along.

The startling growth in the number of blow molders from seven in 1956 to 80 in 1959 begins to make quite a lot of sense when one takes a look at some of the fantastic packaging markets that are shaping up.

In the much-publicized area of household detergents alone, current estimates anticipate *a future annual market of 400 million containers.* Just how big this figure is can best be illustrated by the fact that the total number of polyethylene containers of all types turned out by the entire blow molding industry this year was probably somewhere in the *500- to 600-million unit category.* Thus, when the detergent business takes hold next year, total production of blown polyethylene containers could easily be *doubled to a minimum figure of 1 billion units.* And this is only part of a much larger container

Second article in series spells out fabulous market potentials and details setup costs and production returns

Photo, Koppers Co. Inc.

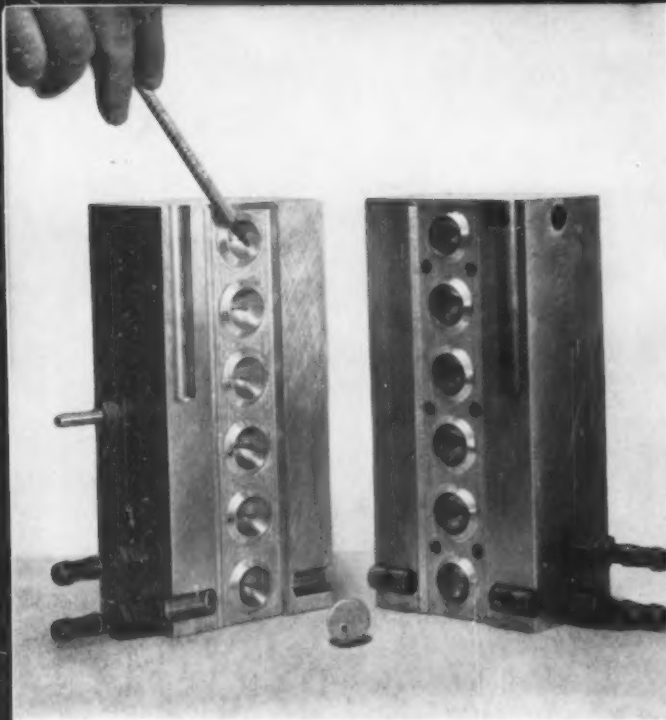
POLYETHYLENE boat fenders—inexpensive, lightweight, and unsinkable—are among the many new types of products that are now taking advantage of blow molding techniques.

market that plastics materials have a good chance of conquering. T. W. Mullen of Celanese Plastics Co. has estimated that "of the 44 billion metal cans consumed in the United States in 1958, from 4 to 5%, or *approximately 2 billion units,* represent the total potential for a rigid blow molded polyethylene container . . . and about *15 to 20% of the more than 20 billion glass containers* made each year represent an area of immediate penetration."

To anyone who is considering entering the field, the impressive million- and billion-unit packaging figures serve as the immediate inducement—the immediate market to start the machines rolling. At the same time, the toys, housewares, industrial components, and other non-packaging applications described last month stand out as the springboard to future expansion and diversification. When and if these applications match the packaging volumes—and there are some who maintain they will eventually outstrip it—then blow molding will really be up there on a level with the other major processing techniques.

Who will be doing what?

It must be remembered that much of this new business will be emanating from companies of the caliber of Lever Bros., Procter & Gamble, and such. Chances are, therefore, that much of their requirements will be met by the companies who have the financial ability and technical know-how to turn out the huge volumes needed. And this includes blow molders such as Plax Corp.; Imco Container Corp.; Royal Mfg. Co. Inc.; Wheaton Plastics Co.;



Photo, Boston Plastic Machinery Inc.

MULTI-CAVITY MOLD turns out six blown artificial grapes (one shown in foreground). Units are strung vertically in a row and cut apart after blowing. Air enters through needle (pencil point) which pierces parison.

Owens-Illinois Glass Co.; and Continental Can Co. Inc.—who have already spent considerable time and monies in developing the market—together with those potential producers now in the metal can or glass bottle business who certainly are not anxious to lose this lucrative market by default.

On the other hand, however, taking into account some of the future requirements, there seems to be little doubt that there is *still* a sizable chunk of the market left over for smaller firms already in the business or planning to enter. If some of the blow molding giants are going to have their hands full just filling household detergent bottle orders, then there is opportunity for others to accommodate liquid floor waxes (an 80 million container market), automotive specialties (100 million containers), liquid bleach (400 million containers), liquid starch (60 million containers), liquid ammonia (70 million containers), and other household and industrial chemicals. Just getting a part of this potential market or just picking up the overflow on the big runs going to the "giants" can be a profitable undertaking for any company that is interested.

Then there are the short runs in the more specialized areas. Fish-shaped containers for holding a liquid bubble bath, caricature dispensers for children's vitamins, and hot dog-shaped dispensers for mustard are some of the items which fall into this category.

Other lucrative areas

The packages described above—for household and industrial chemicals—are, of course, not the only possibilities. Blow molded cosmetic containers, nursing bottles, and aerosols are continuing to grow in popularity. Bellows-type packages designed either for complete collapse (to empty the entire contents of the package) or for snap-back action (to permit specific amounts to be portioned out from the package) have already been used for products that range from whiskey to glue.

In the industrial area, carboys are becoming larger and more in demand. One manufacturer, using a combination injection molding-blow molding technique, is producing drums from 5 to 55 gal. in capacity. And industry sources are already talking about blow molded drums that may stand 7 ft. high. In Germany, blow molded 1½-gal. gasoline cans are becoming fairly common—and have already led to such developments as blow molded gasoline tanks for small engines.

The "bottle-in-a-box" concept—in which a thin-gage (about 10 mils) liner is blown and inserted into a cardboard carton—has also started to take hold. John H. Breck Inc., for example, reports that a liner of this type used with a corrugated carton for shipping liquid shampoo costs 4% more than the previously used glass bottle, but because of the 83%

Photo, Celanese Plastics Co. and Kautex

DOUBLE-WALL CONSTRUCTION for insulated bottle (right) is effected by blowing inner container (left) and outer container (center) separately and then joining the two together.

weight savings and an approximate 30% reduction in cubage, has effected economies of some $20,000 per year. With other manufacturers reporting similar savings, blow molders are already starting to tool up to supply such liners in capacities up to 15 gallons.

It is impossible to really cover the entire packaging picture. Rigid vinyl packages and chlorinated PE-vinyl packages are still under evaluation and blow molded toothpaste-type tubes, as another example, are just starting to get off the ground (see photo, p. 168). It's big—and it's growing bigger! The potential offered in this one area should suffice to indicate how important the blow molding technique has become to the plastics industry.

Blow molding equipment

To newcomers attracted to blow molding by the size of the markets involved, the many types of machines now being offered may at first seem confusing. Basically, however, most of the machines involve a heated hollow tube (a parison) trapped in a mold, inflated by air pressure until it expands against the walls of the mold, and then held in place under pressure until the material sets up.

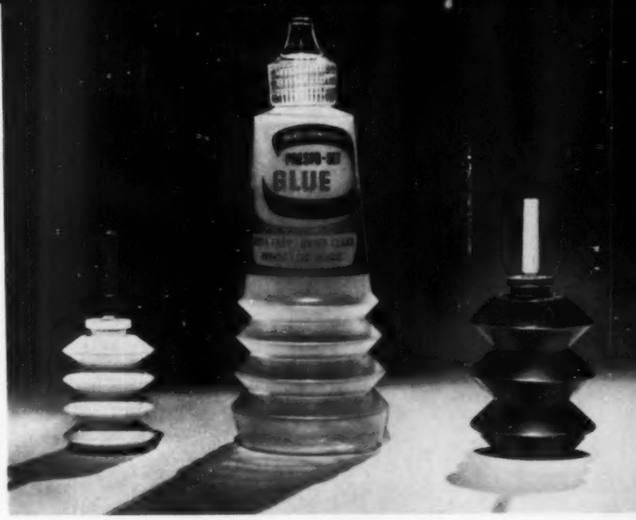
Most of the machines also break down into several basic groups:

1) The parison is injection molded separately around a hollow core and then transferred manually or mechanically to the blow mold. (e.g., Moslo equipment)

2) The tube is extruded directly into a stationary mold (extrusion has to be stopped while tube is blown) or continuously into a rising mold (which closes on the extruded parison at the top of the stroke, severs the parison, moves down with it while extrusion continues and blowing takes place, and then moves back to the top of the stroke to repeat the cycle). (e.g., Kautex and Blow-O-Matic equipment exemplifying rising mold type of equipment.)

3) The extruder is fitted with a pressure balanced manifold, carrying several extrusion die heads, beneath which are independently operating molds. While one parison already in the mold is being blown, the extruded material is diverted to the other mold. (e.g., Air-Formed, Auto-Blow, Boston Plastic Machinery, and F. J. Stokes Corp.)

4) A rotary table is mounted in a fixed position (in horizontal or vertical plane) adjacent to the extruder. The parison is extruded into molds in the table which moves continuously or by intermittent indexing. (e.g., Eisler)



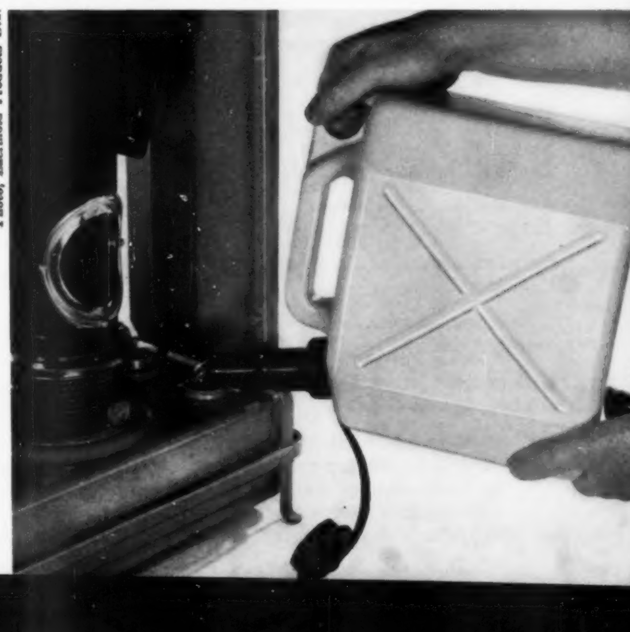
Photo, Wheaton Plastics Co.

VERSATILITY in the dispensing function is effected by blown "bellows-type" packages designed either to snap-back for partial dispensing (center) or for complete collapse (left and right) to empty entire contents of package.

Each type of machine, of course, has its own advantages and disadvantages, as detailed in Vernon Hill's article in the July 1959 issue of MODERN PLASTICS, p. 88, and each has its own particular areas of specialization. Which will turn out to be the general-purpose machine is yet to be seen; but it seems more likely that a well-diversified blow molder will make use of several types to give him the range of versatility he needs. To illustrate, one major blow molder in the packaging field reports that he is using eight different types of machines, some custom built just for a specific application.

It must be remembered, too, that several com-

TYPICAL BLOW MOLDED application in industrial field is a rigid 1-gal. can of high-density polyethylene that can be used to store and transport non-volatile liquids.



Photo, Lacrinoid Products Ltd.

Photo, Auto-Blow Corp. and Aztec Container Corp.

TOY MILK CANS and clowns indicate the diversity in shape and contour that can be achieved by the blow molding technique.

pletely new types of machines for blow molding are expected to see the light of day within the next few years. From Europe, for example, come reports of machines that are turning from both the injection and extrusion methods to the high-production shaping techniques commonly used in the metal and glass industries. One such machine currently under development reportedly can turn out containers on the order of 5000 to 6000 an hr.—a rate that approaches the speeds common to glass blowing.

Considering the rate at which machinery manufacturers are entering the field, many refinements and improvements are probably already on the drawing boards. The list of American and overseas manufacturers of blow molding equipment below **(To page 210)**

American Manufacturers and American Representatives of Overseas Companies

A Air-Formed Products Corp.
Nashua, N. H.

B Auto-Blow Corp.
Bridgeport, Conn.

C Battenfeld Corp. of America
Chicago, Ill.

D Blow-O-Matic Corp.
Bridgeport, Conn.

E Boston Plastic Machinery Inc.
Boston, Mass.

F Eisler Engineering Co. Inc.
Newark, N. J.

G Fischer, Johann, Co.
(Barclay Industries Inc.)
New York, N. Y.

H Granbull Tool Co. Ltd.
(Newark Die Co.), Newark, N.J.

I Kautex-U.S. Sales Co. Inc.
Flushing, N. Y.

J Moslo Machinery Co.
Cleveland, Ohio

K Rudolph, Martin, Co.
(Norca Machinery Corp.)
New York, N. Y.

L F. J. Stokes Corp.
Philadelphia, Pa.

Overseas Manufacturers

M Alpine AG., Maschinenfabrik und Eisengiesserei
Augsburg, Germany

N Amigo Machine Co., London, England

O Aviaplastique, Paris, France

P Bekum Berliner Kunststoff-Verarbeitung GmbH
Berlin-Alt-Lankwitz, Germany

Q Berstorff, Hermann, Maschinenbau-Anstalt
Hannover-Kleefeld, Germany

R Chemica AG., Zurich, Switzerland

S Covema s.r.l., Milan, Italy

T Flesch, P., Maschinenfabrik
Luedenscheid/Westf., Germany

U Fuji Koshis Plastic Molders
Tokyo, Japan

V Hermann ter Hell & Co., GmbH.
Hamburg, Germany

W Kato Seisakusho Co. Ltd.
Tokyo, Japan

X Kleinewefers Sohne, Joh., Maschinenfabrik
Krefeld, Germany

Y Lavorazione Materie Plastiche
Turin, Italy

Z MOI, Milan, Italy

AA Matsuda Mfg. Co. Ltd.
Saitama Pref., Japan

BB Negri Bossi & Co.
Milan, Italy

CC Netstal AG., Maschinenfabrik und Giesserei
Netstal/Gl, Switzerland

DD S. A. M. A. F. O. R.
La Courneuve/Seine, France

EE S. C. A. E., Florence, Italy

FF Schulte-Ultex Arbeitsgemeinschaft
Düsseldorf, Germany

GG Thermo Plastics Industry Co.
Tokyo, Japan

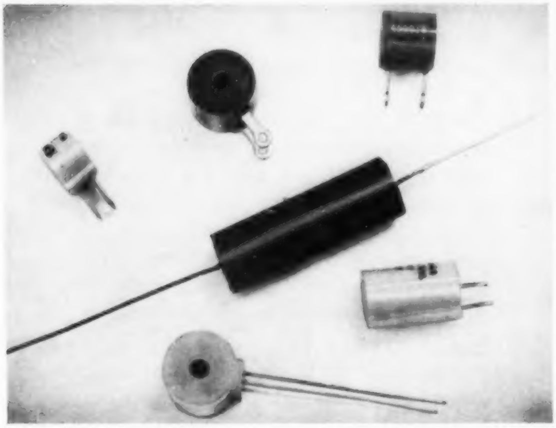
HH ToHo Chemical Industry Co. Ltd.
Tokyo, Japan

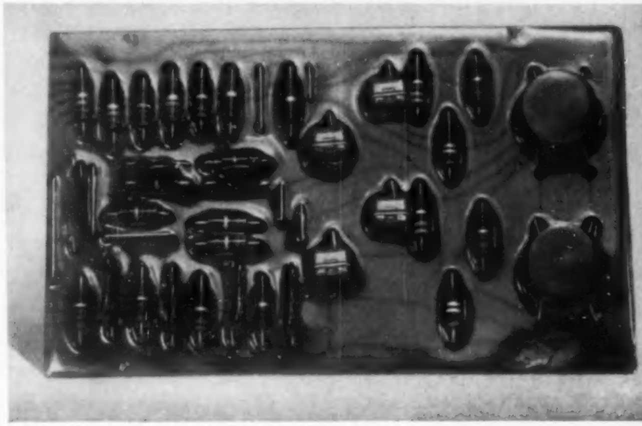
II Wenigmann, Heinrich Maschinenfabrik
Haan/Rhld., Germany

Readers interested in obtaining additional data on any of the machines listed above are invited to use the convenient self-addressed postcard on p. 201. Simply circle the letter in the special box on the face of the postcard that corresponds to the letter in front of the manufacturer's name above. Return the postcard to this office and MODERN PLASTICS will be happy to pass your request along to the manufacturers.

#15, #16 in a series

EVERYBODY NEEDS EPOXIES





FIRST USE OF EPOXIES in the electronics industry was for wire-wound resistors such as those shown at left. These were prepared by the U. S. Army Signal Corp., at Ft. Monmouth, N. J., in the early '40s. The first completely encapsulated printed circuit (right) was produced there in 1949.

Compounds for electronics

By John M. Jewell* and William C. Jenner†

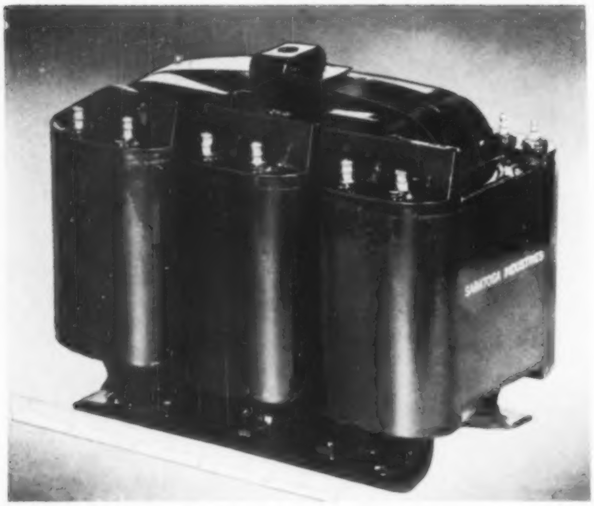
Since the early part of the 1940's, the electronics industry has grown to such a degree that today it is an independent industry branch of American business, with every indication pointing to an ever increasing expansion as the years go on.

Subminiaturization of components is an integral part of this broad program, and it is here that epoxies play a vital part by protecting resistors, coils, capacitors, motors, transformers, and switches against moisture, heat, vibration, shock, and electrical loss. Epoxies are chosen for these applications, because they also keep down weight and bulk and the compounds are adapted to rapid production techniques. Basically, epoxies possess excellent electricals, low water absorption, low shrinkage when cured, toughness, and good resistance to shock. However, they have to be modified in order to build in and improve these characteristics.

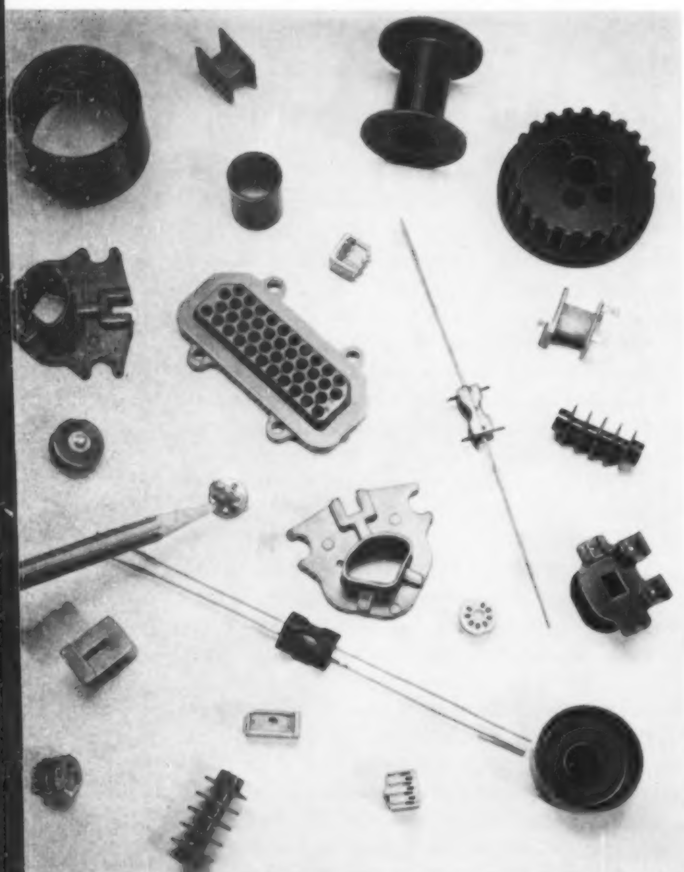
For example, flexibility and resistance to extreme temperatures are vital in all coatings that will be subjected to thermal and mechanical shock, and epoxies have to be especially compounded in order to possess these properties in the degree that is required. Until recently a resin that did not crack at −33° F. or unduly soften at 180° F, was acceptable. Not so now! Today it is fairly common to see specifications calling for an operating range between −80 and 300° F. This range is achieved through reactive plasticizers, through the novolacs and peracetic acid resins, through new types of hardening agents, as well as through the use of specialized fillers.

Another important aspect is the problem of space and weight. These can be approached by way of foams and low-density casting compounds, or through the use of dipping compounds whereby a thin, even coating can be applied without sacrifice of protective qualities. Casting insures absolute uniformity and adds an attractive appearance to units, but dipping, particularly multiple dip, provides substantial production savings where small electronics parts are called for, or where entire printed circuits are to be coated. In the past, excessive build-up, excessive run off, edge pulling and a limited pot life jeopardized success. These problems have now been overcome, and two-compo-

*Field Sales Mgr.; †Mgr. Electrical Insulating Div., Houghton Laboratories Inc., Olean, N.Y.



TRANSFORMER unit cast in a single-component epoxy resin.



PROVEN APPLICATIONS of compression molded epoxy resins include condensers, bobbins, relay assemblies, small coils, and housings in which other electronic units may be cast.

nent epoxies with a dip life exceeding three months are now available. These insure even, tough coatings with almost no drippage, resulting in a complete dip coating family that will mean both better performance and lower application costs.

Another important development for use in electronics is the new epoxy molding powder designed for automatic production. Multi-cavity compression or transfer molding of encapsulated units are now possible. Single-component dry powders are available, some of which are filled with minerals to reduce shrinkage, and others with glass fiber or asbestos to provide added resistance to impact. Hysol 8610 is of this classification and offers a storage stability exceeding 1 year at 77° F. This means no refrigeration costs and the opportunity to purchase these materials in economical quantities. Molding pressures vary from 1000 to 8000 p.s.i., depending on the method used and on wall thickness. Successful uses include the molding of condensers, bobbins, relay assemblies, and small coils, as well as housings in which other units may be cast.

To sum up, two-component, short-pot-life systems are being replaced by single-component materials. Where two-component systems are still in use, a practical working pot life has been achieved. Unreliable flexible compounds are now replaced with those offering selective flexibility and insured operation from −80 to over 300° F. Slow curing materials have been replaced by systems geared to automatic production. Shelf life has, likewise, been increased from weeks to years, and material costs are considerably less than half of what they were nine years ago.—**End**

SMALL ELECTRONICS part dip-coated in a two-component system has tough coating with practically no drippage. Pot life of the compound was three months.

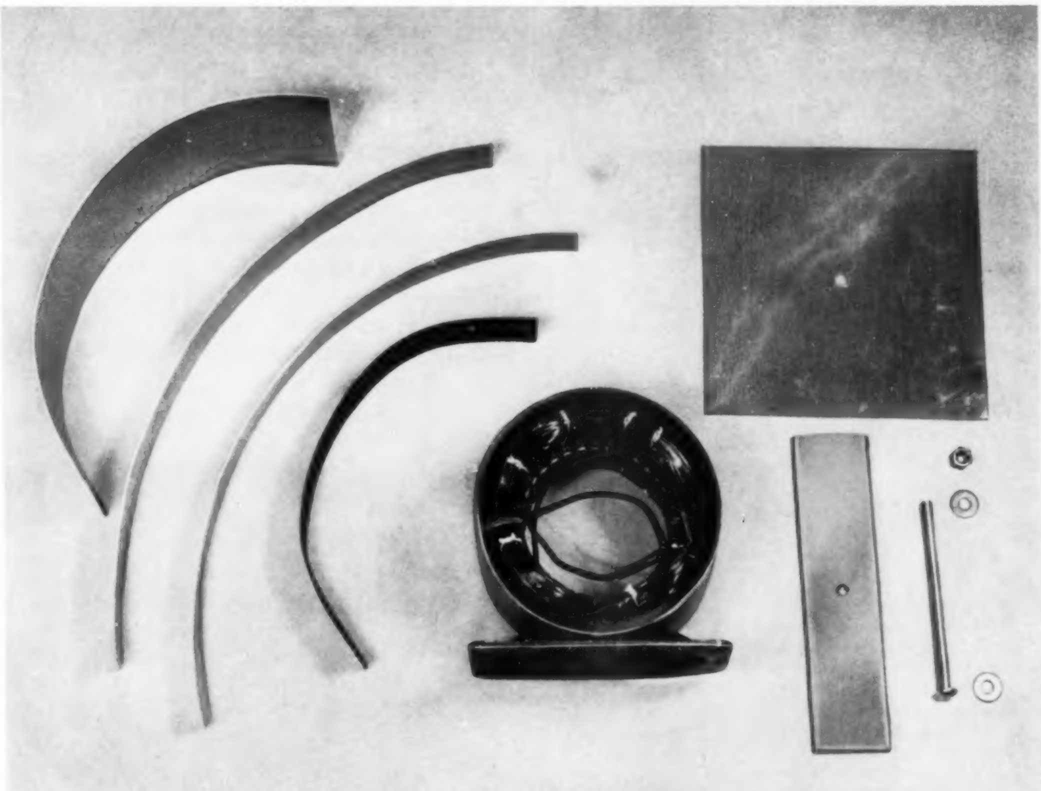
Motors get new lease on life

There's a quiet revolution taking place in the electric motor field: epoxy-encapsulated, open-type electric motors are increasingly replacing fully enclosed types—at sizable savings to the end user. This revolution started shortly after World War II in some progressive repair shops that insulated motor windings with epoxies. Two recent cases point out the savings that can be obtained.

- A Dubuque, Iowa packing house had a neck bone washer motor that went out for rewinding every three months. At $30 per rewind, the annual repair bill on the one motor was $120, not counting down time in the plant. After being insulated with epoxy resin by the Dubuque Electric Motor Co., at a cost to the packing plant of $57, the motor has been running for two years. This represents a saving to the packing firm of $183 in rewind cost alone.
- A corn processing plant in the Midwest had a 10-hp. Ilg fan motor mounted in a steam duct which broke down every three weeks. Impregnated and capped with epoxy resins, the motor is still going strong after eight months.

Today this development has reached the point where encapsulation of stators takes place during the original manufacturing process. Using standard vacuum impregnating equip-

This article is based on information supplied by Minnesota Mining & Mfg. Co.



AFTER FIRST THREE STEPS in no-mold system have been executed, mold parts are cut from phenolic sheet. The widest strip is the center core. The two medium narrow strips are the end molds, and the narrowest strip the locking strip for the core. The square sheet is the mold base and the metal strip the top clamp. The bolt runs through the center core to hold mold in position.

CENTER CORE SHEET is coated with mold release and inserted in stator, where the rotor goes, and is overlapped as shown. The locking strip is next inserted on the inside of center core.

ment, manufacturers found that epoxy encapsulated motors could successfully compete with totally enclosed motors in many applications with a considerable price saving.

- Motor installations in the chemical and petroleum industries have proved that epoxy-encapsulated, open-type motors can safely be used in outdoor locations where enclosed motors were previously specified. Savings of up to 60% are obtainable relative to "totally enclosed field coil" (TEFC) motors. At least 35% savings can be expected over the cost of weather-protected enclosures using a system of baffles to keep moisture from the insulation.
- An epoxy-encapsulated motor, substituted for a totally enclosed type, drives an acid pump in a chemical plant, where it is subjected to acid fumes and dripping moisture. No detrimental effects have been noted after more than 18 months' service.

Many other such examples could be cited. However, the point is clear: the new motors bring substantial savings.

How to repair them

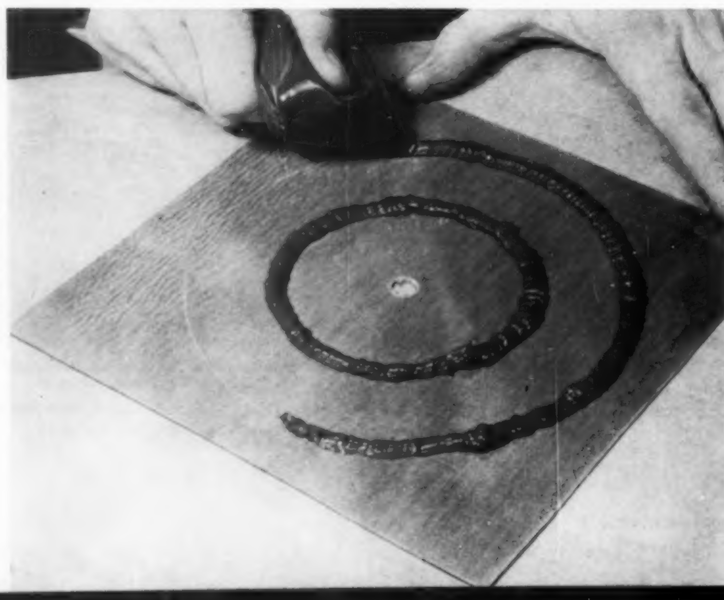
The electric motor repair industry is now faced with the need to devise methods of repairing the new motors, if and when they do need rewinding. There are generally two methods available; one uses a mold of some sort, the other using no mold.

A no-mold system, developed by 3M jointly with repair shops, has found considerable success. Here is how it works, step by step. (Resins used were Scotchcast Nos. 214 and 241.)

1. Burn out and clean stator.
2. Impregnate stator with all-purpose, clear,

WITH LOCKING STRIP in place, thick resin is spread around the inside of the housing at the laminations to form a seal bed for the outside molding strip. Outside strips are then coated on the winding side with mold release and bent and forced down into the seal head.

STATOR with outside mold strips is placed near center of mold base and circumference of outside mold strip and center core scribed in base. Thick resin is laid along the lines scribed to provide a seal at mold bottom. Area between beads is coated with mold release.



heat-reactive baking varnish of low-viscosity impregnating resin. Force 214 (thick resin) into large cracks in laminations to prevent later leakage. Cure at 150° F. for 1 hr. or at room temperature for 4 to 6 hours.

3. Rewind in accordance with motor rating, allowing minimum of 3/8 in. for end bells.

4. Cover slot sticks with thick resin. Trim out excess to provide rotor clearance and notch each slot so resin is below face of stator.

5. Butter up one end of coils with 214 resin to 1/8 in. above ends of coil. Make continuous seal from inner to outer laminations. Smooth out with hot spatula. Turn motor upside down and seal other end of coil to laminations, leaving open ring at coil ends for pouring impregnating resin. Cure 1½ hr. at 150° F. or 24 hr. at room temperature.

6. Preheat stator for 1 to 2 hr. at 275° F. Impregnating resin can be weighed and mixed as stator preheats.

7. Pour 241 impregnating resin, tilting stator to let air escape. If leaks appear, remove impregnating resin from stator.

8. Patch all leaks with thick resin and cure for 15 to 30 min. to gel resin patches.

9. Repour impregnating resin into one side of the ring left in end coils. Tilt stator enough to allow air to escape.

10. Cure for 2 hr. at 250° F. allowing enough time for stator to come up to cure temperature.

11. Butter up opening left over end coils with the thick resin and use hot spatula to smooth it down for appearance. Give stator a final cure of 1½ hr. at 150° F.

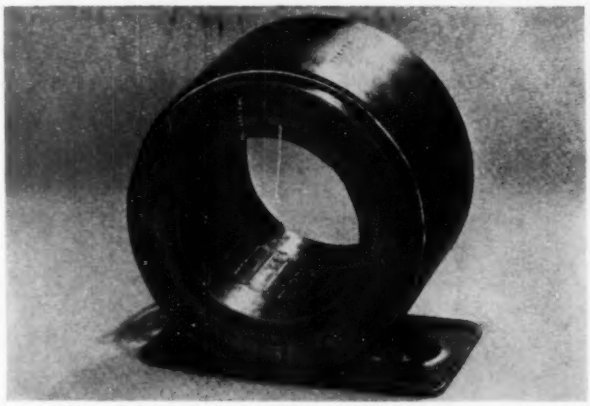
The with-mold repair method is illustrated in the accompanying illustrations.

Encapsulated motors require procedures somewhat different from those that are used in conventional stators.

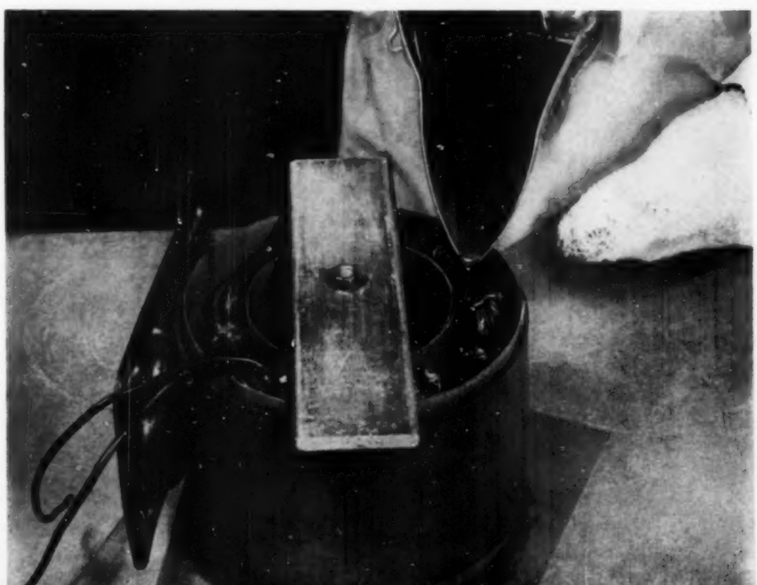
Burning out a motor

Stators must be brought to about 750° F. until resin flashes. Oven should then be turned off. The resin will normally burn for approximately 15 to 30 minutes.

Repair shops having a refractory-lined oven will have no problem. However, many shops have metal-lined ovens which will not tolerate the temperature produced by the burning resin (1200° F.). In metal lined ovens it is reported that temperatures of between 500 and 550° F. will decompose the resin. At that temperature, most epoxies will become soft enough to allow wires to be stripped. If held at temperature for a time and then cooled, the resin may look normal but will be extremely brittle and can be knocked off easily.—End



AFTER the resin is cured, the mold parts are carefully knocked off the stator, here shown in finished shape.



BEADS are smoothed against sides of outside mold strips, the bolt run through mold base and through top clamp, and the stator quick cured. After curing, the hot stator is poured full of impregnating resin. Stator should be tilted enough to permit the air to escape.

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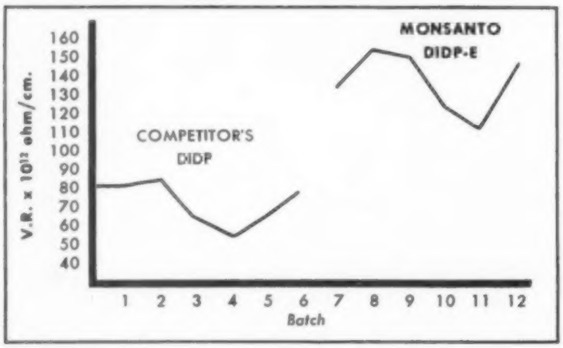

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	24 hrs. @ 50° C.	100.0	180.0
	1 wk. @ 50° C.	200.0	310.0
	5 wks. @ 50° C.	170.0	260.0
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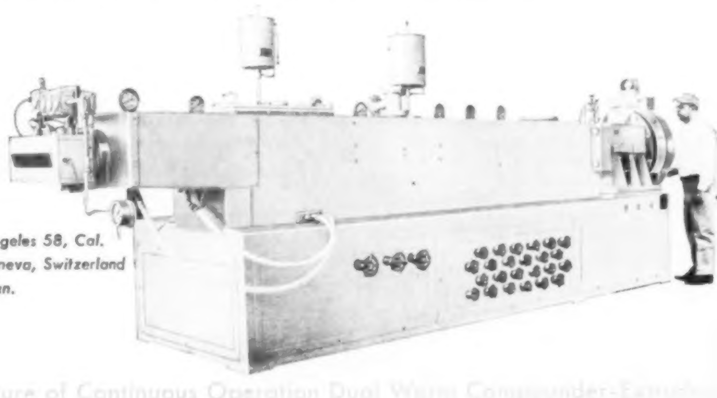

George R. Smoluk, Engineering Editor

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Roll-chilled PE film

Current status of industrial technology and how resin characteristics and operating factors affect film properties

By J. A. Doti†, G. E. Tolle†, and C. S. Imig‡

Chill-roll casting is not a new technique, but only recently has it become a technique by which quality PE film can be produced economically. Today resin technology has expanded PE resin densities into the range of 0.91 to 0.96. These new, denser resins provide stiffer PE films, minimizing or eliminating the difficulties encountered previously with roll-chilling. The new films were clearer, too.

Slip additives now overcome the tackiness of low-density films made by chill-roll casting, though high levels of additive are required to produce good surface characteristics. Using resins with densities around 0.918, roll-chilled film exhibits the usual excellent toughness with a bonus of improved clarity. The 0.925-density resins also display an improvement in toughness and it is now generally recognized that the intermediate-density resins give the greatest clarity. So great is the gain in clarity with roll chilling that reasonably clear films can be obtained even with the higher-density resins, permitting film makers to take advantage of the higher stiffness of these materials.

Equipment is simple

The equipment needed to make roll-chilled film is not very unusual.[1] An extruder equipped with any flat-film die can be used, providing the die lips can be brought very close to the roll. The two main die types are shown in Figs. 1A and 1B, below. Figure 1A illustrates a "coat-hanger" type with die-lip adjustment from one side only. In this design, there

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‡Present Address: President, National Plastic Films Inc., Ottawa, Kan.

[1]Some discussion of present commercial equipment and practices was given in "How to make roll-chilled polyolefin films commercially," by F. J. Meyer. (MPI, August 1959, p. 97).

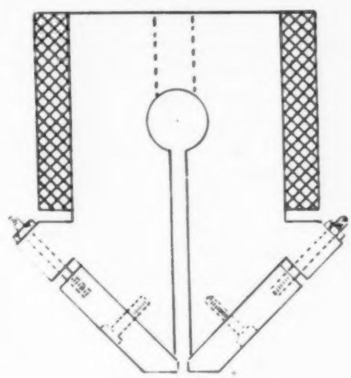

FIG. 1B: Slot die designed for paper coating.

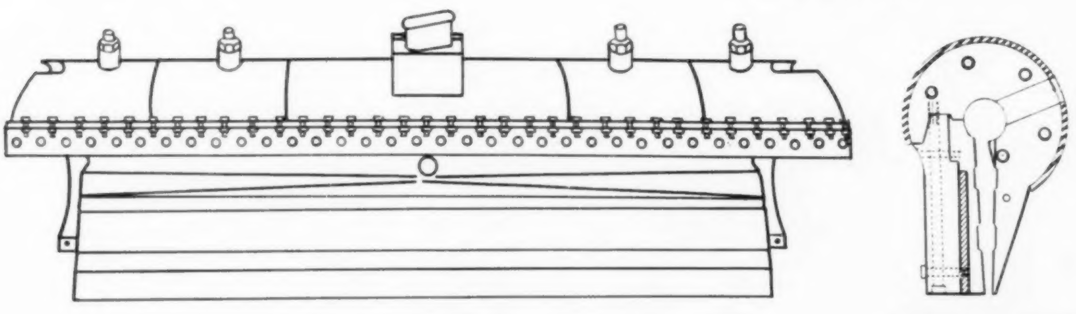

FIG. 1A: Coat hanger-type die used in extrusion of film by chill roll technique.

Table I: Factor levels in random-balance experiment

Factors		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Air gap	L equals 1 in. H equals 4½ in.	H	L	L	L	L	H	L	H	H	H	H	L	L	H	H	H	H	L	H	H	L	L	L	L
Density	L equals 0.918 M equals 0.925 H equals 0.933	L	H	M	M	L	L	L	M	H	M	M	M	M	L	H	L	H	H	M	H	L	H	H	L
Lubricant (Slip additive, %)	L equals 0 M equals 0.025 H equals 0.065	M	L	H	L	M	H	H	H	L	M	L	M	L	H	L	L	L	M	M	M	H	H	H	M
Haul off	L equals 110 ft./min. H equals 150 ft./min.	H	H	L	L	H	L	H	L	L	H	H	H	L	H	H	L	H	L	L	H	H	L	L	L
Chill roll temp.	L equals 75° F. H equals 120° F.	H	L	L	L	H	H	H	H	H	H	L	L	L	L	H	H	H	L	L	H	L	H	L	L
Stock temp.	L equals 475° F. H equals 550° F.	H	H	L	H	H	H	L	H	H	L	L	L	L	L	H	L	H	L	H	L	H	H	L	L

is a varying restriction built into the die which tends to distribute the polymer melt more uniformly over the width of the die lips and subsequently gives a more uniform extrusion rate across the web. One-side die-lip adjustment is best because the non-adjusting side can be placed very close to the chill-roll. Land length in such dies is about ¾ to 1 inch.

Figure 1B illustrates the second general type of die design used. It is commonly used in extrusion-coating operations and is generally found in chill-roll extrusion lines which have been converted from coating. This type of die can be used successfully but is usually more troublesome than the other. Gage control is often more difficult because of the non-uniform distribution of the melt along the width of the die. Land lengths are in the vicinity of ¼ in., which is normally considered too short for the best film-extrusion operation.

It has been argued that a "coat-hanger" die can be designed for only one particular melt-flow characteristic and, therefore, the design is not versatile enough. This is true in the sense that any fixed geometry will fit the flow characteristics of only one resin perfectly. However, the problem

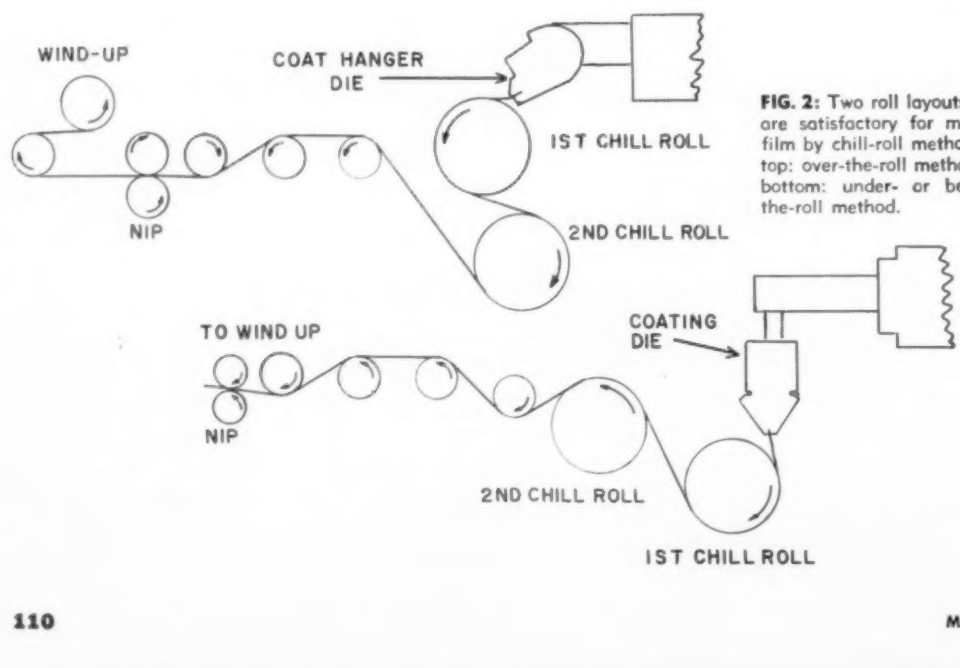

FIG. 2: Two roll layouts that are satisfactory for making film by chill-roll method. At top: over-the-roll method; at bottom: under- or behind-the-roll method.

of distributing the melt uniformly is pretty much the same for all plastics. Therefore, even though the geometry is exact for only one polymer, it is at least a giant step in the right direction for all others. That this is true can be readily observed during transition between different resins of different color.

Chill rolls

The design of the chill-roll take-off has not yet been standardized—but two or three water-cooled rolls seem advisable. As Fig. 2, p. 110, shows, the melt can be extruded either over or under the first roll. Which method is used seems to be a matter of personal preference. The same contact area can be obtained with either system if the rolls are properly located with respect to one another. At present, it appears that under-the-roll casting may allow easier access for die adjustment with extremely large dies. The illustration shows only two chill rolls; however, additional rolls could be added depending on the extruder's requirements.

The chill rolls themselves vary in size from 10 to 24 in. in diameter and every film caster seems to have his own idea as to what the ideal size should be. In order to get the best-appearing film, the rolls should have polished chrome surfaces. Experience with unpolished rolls has shown that it is sometimes possible to attain high clarity and gloss when extruding films about 1-mil thick. However, with heavier gages the clarity and gloss suffer. An unpolished roll surface also makes it harder to observe the frost line than with a polished surface. This may seem trivial, but setting the die lips for uniform gage is much easier when the frost line is clearly visible. Of course, the frost line should be as straight as possible, as well as parallel to the die lips.

The temperature of the first chill roll strongly influences certain film properties and it should be closely controlled. Subsequent chill rolls serve primarily to cool the film sufficiently before wind-up to prevent blocking or collapse of the winding core.

It is generally conceded that higher production rates are practicable with chill-roll cooling than by other methods, and speeds are claimed to be as high as 400 to 500 ft./min. Customers are asking equipment makers for machines capable of operating at 1000 to 1500 ft./min. At present, there are serious problems connected with such speeds. For the sake of this discussion, production speeds will be considered to be in the vicinity of 150 to 200 ft./min.

Random balance experiment

A major problem of this new film-making process is the scarcity of quantitative data on the influence of resin properties and process conditions on the properties of the finished film. To help remedy this situation, we set up an experiment designed to estimate the effects on 10 film properties of six operating factors suspected of being important determinants of these properties. These operating factors were:

1) Resin density: Three resins having densities of 0.918, 0.925, and 0.933, designated as low, medium, and high (L, M, and H), were used. It was felt that this range of values represented the resins currently being used in the chill-roll process.

2) Lubricant: Three levels of lubricant were used: none, 0.025%, and 0.065%, again designated as the low, medium and high levels (L, M, and H).

3) Air gap: This is defined as the distance between the die lips and the line of contact where the film meets the roll. Two levels, L = 1 in. and H = 4.5 in., were used for this purpose.

4) Roll temperature: This quantity was thought to be fairly represented by the temperature of the cooling water entering the roll. Two levels, L = 75° F. and H = 100° F., were used.

5) Stock temperature: Two stock temperatures, 475 and 550° F., were used. These temperatures

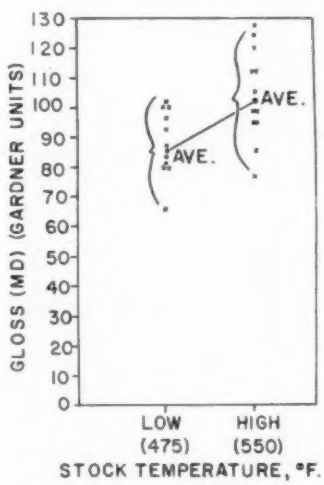

FIG. 3: Scatter plot of gloss values for two levels of stock temperature. Even though spread of data is great, it is clear from data available that gloss improves with rising stock temperatures.

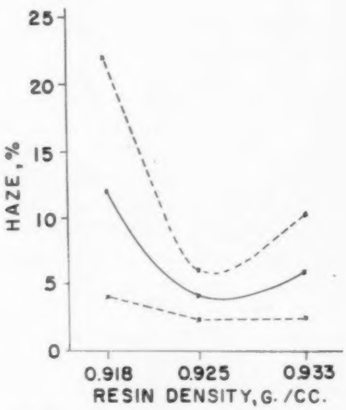

FIG. 4: Three-level plot for resin density reveals haze minimum at 0.927. Note also that at any density level haze can be varied considerably by adjusting other factors (dashed lines show extreme low and high values obtained at various density levels, while the solid line shows the average values.)

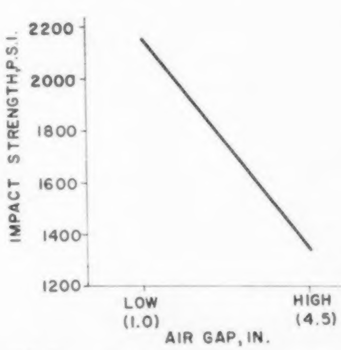

FIG. 5: Impact strength, measured with a modified Elmendorf tear tester that permits a ¾-in. ball to puncture specimen, decreases sharply as air gap widens. Only average values are shown on this graph.

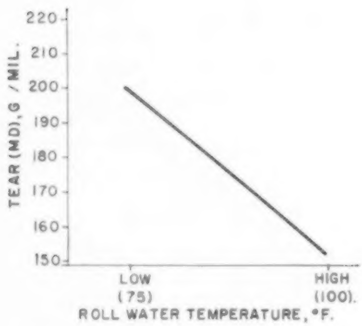

FIG. 6: Tear strength in machine direction is higher at lower roll temperature, and it drops about 1% per °F. rise in roll temperature.

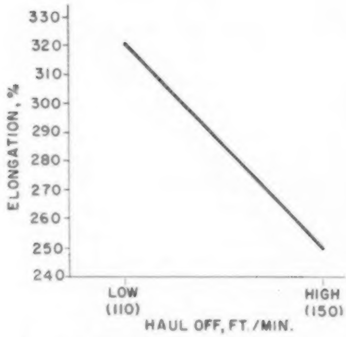

FIG. 7: Tensile elongation is better at lower haul-off rates, possibly because of less residual stress in slower-drawn film.

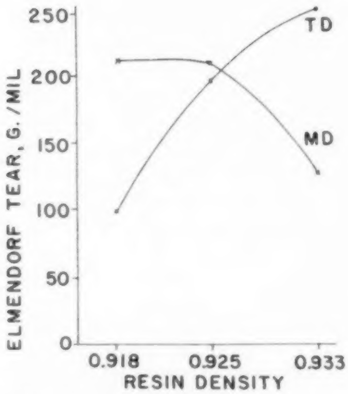

FIG. 8: Tear strength (MD) slides sharply off plateau at densities above 0.925, while transverse-direction strength rises over whole range. Crossing point defines density at which the tear is equal in both of the directions.

were expected to bring out not only the best but also the worst qualities of the resins.

6) Haul-off speed: Two levels, 110 and 150 ft./min., were used.

The tested properties of 1¼-mil film tested were: film density; gloss (in machine [MD] and transverse [TD] directions); haze; slip (i.e., coefficient of friction); Elmendorf tear strength (MD and TD); tensile strength (MD); elongation (MD); impact strength.

It has been recognized for some decades that, in multi-factor experiments of this kind, the effect of any particular factor on a given property is likely to be influenced by the levels of the other factors. Statisticians refer to this joint influence of factors as "interaction," and they have devised ways to evaluate interactions or to balance them out. One of the earliest ways was to conduct a "full factorial" experiment. This simply means that each of the factors is tested at *all* the levels of the others. Thus, if there were two experimental factors to be tested at two levels each, four test runs would be the minimum needed. For three factors at two levels, the minimum number would be eight, and for three factors at three levels, 27. We have six factors, two at three levels and four at two levels, so the full factorial experiment would require $3 \times 3 \times 2 \times 2 \times 2 \times 2$ equals 144 test runs! With 10 tests to be made on film samples from each run, such an experiment would take a long time and be rather expensive. Recognizing that full factorial experimentation would be too costly in many multi-factor systems, the statisticians set about devising ways of

Table II: Test results in random-balance experiment on chill-roll cooling of extruded PE films

Run No.	1	2	3	4	5	6	7	8	9	10	11	12
Slip (Coeff. of friction)	1.31	.82	.47	3.60	.30	.15	.06	3.15	4.31	.93	1.51	.54
Gloss (MD) (units)	106	95	97	113	86	95	61	128	125	100	101	87
Gloss (TD) (units)	96	92	92	110	74	81	46	121	126	95	97	81
Film density, g./cc.	0.9139	0.9257	0.9207	0.9202	0.9142	0.9140	0.9138	0.9217	0.9209	0.9199	0.9200	0.9190
Tear (MD) g./mil	140	151	271	195	237	156	319	126	130	245	212	347
Tear (TD) g./mil	118	225	193	238	98	113	75	165	165	225	248	180
Impact strength, p.s.i.	2042	1067	1547	1050	1941	1504	3945	941	836	980	1115	1724
Haze (MD), %	4.5	6.8	6.2	3.6	7.9	6.4	21.3	3.0	2.6	5.7	4.7	8.2
Tensile (MD), p.s.i.	2130	3250	3385	2769	2976	2679	4021	2022	2015	2471	2875	3226
Elongation, %	215	250	340	250	185	270	100	460	360	320	350	260
Run No.	13	14	15	16	17	18	19	20	21	22	23	24
Slip (Coeff. of friction)	1.45	.08	1.0	2.03	1.05	.21	4.50	.54	.07	.18	.10	.31
Gloss (MD) (Gardner)	100	66	113	81	109	83	121	93	64	99	80	80
Gloss (TD) (Gardner)	95	53	113	69	108	80	124	91	46	95	79	68
Film density, g./cc.	0.9189	0.9140	0.9263	0.9139	0.9262	0.9252	0.9201	0.9263	0.9138	0.9264	0.9259	0.9129
Tear (MD) g./mil	267	211	96	160	143	160	137	28	278	106	228	191
Tear (TD) g./mil	189	77	288	98	269	239	176	309	81	267	231	90
Impact strength, p.s.i.	1317	2132	1169	2023	1197	1763	995	1263	4207	1541	2090	3451
Haze (MD), %	5.7	15.5	4.5	8.9	4.8	9.7	2.6	7.6	18.7	6.1	10.5	11.3
Tensile (MD), p.s.i.	2844	2997	2970	2313	3108	3818	2175	3418	3457	3288	3518	3505
Elongation, %	270	130	360	220	380	350	480	360	105	330	280	120

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Table III: Influences of increase in operating factor on chilled roll processed film properties

Property	Resin density	Lubricant	Air gap	Roll water temperature	Stock temperature	Haul-off speed
	Operating factor					
Film density	SI	N	MI	MI	N	N
Gloss (MD)	Max	MD	SI	N	SI	MD
Gloss (TD)	Max	MD	SI	N	SI	MD
Haze	Min	MI	MD	N	MD	MI
Coefficient of friction	Max	SD	SI	N	MI	SD
Tear strength (MD)	Max, SD	N	SD	MD	MD	N
Tear strength (TD)	SI	MD	N	N	N	N
Tensile strength (MD)	Min	SI	SD	MD	MD	MI
Elongation (MD)	SI, Max.	N	SI	N	MI	MD
Impact strength	Min	MI	SD	N	MD	MI

SI — Strongly increases the property.
MI — Mildly increases the property.
Min — Property goes through minimum over factor range.
Max — Property goes through maximum over the factor range.
SD — Strongly decreases the property.
MD — Mildly decreases the property.
N — Factor appears to have no effect on property.

reducing the number of runs to an absolute minimum without, however, giving up the tremendous advantage of balance, in other words, balancing out the effects of all the other factors on the results of each factor.

Recently, a very thrifty way of doing this—called "random balance experimentation"—was introduced. This method completely randomizes the combinations of factors and levels, allows each factor an equal chance to "assert itself" on the system, and does this with only a small fraction of the runs required by the full factorial method.[2] Of course, there is some loss of precision, and the interactions are now mixed in (but in a balanced fashion) with the main effects. Still, the results can be used to identify the more important factors and provide quantitative estimates of their effects. In addition, the procedure is relatively simple. In our case, 24 runs were all that the random-balance method required instead of the 144 for the full factorial method.

[2]A series of articles on random balance experimentation will be found in Technometrics, Vol. I, No. 2, May 1959, published jointly by the American Statistical Assoc. and American Society for Quality Control. See also F. E. Satterthwaite and D. Shainin, "Pinpoint important process variables with polyvariable experimentation," SPE J. 15, 225 (March 1959).

Randomization may be accomplished by assigning the levels in the order determined by random numbers drawn from a special table, or by simply drawing them at random from a box. The particular array of levels we ended up with is listed in Table I, p. 110. Examination of this array will reveal that for each factor, the 24 runs are divided equally among the two or three levels. Thus, eight runs were made at each of the L, M, and H levels of density, for example, and 12 runs at each of the two levels of air gap.

To examine the results, one simply plots the test values of film property tested against the L- and H-level values of the factor of interest to obtain a diagram such as Fig. 3, p. 111. All the values at each level are averaged and the two average values are connected by a straight line. If this line has a steep slope, the factor is obviously important to that property. If the line is horizontal, the factor is probably unimportant to that property. If the slope is neither steep nor zero, but somewhere between, the factor is only mildly (To page 215)

HOW PROPERTIES WERE TESTED

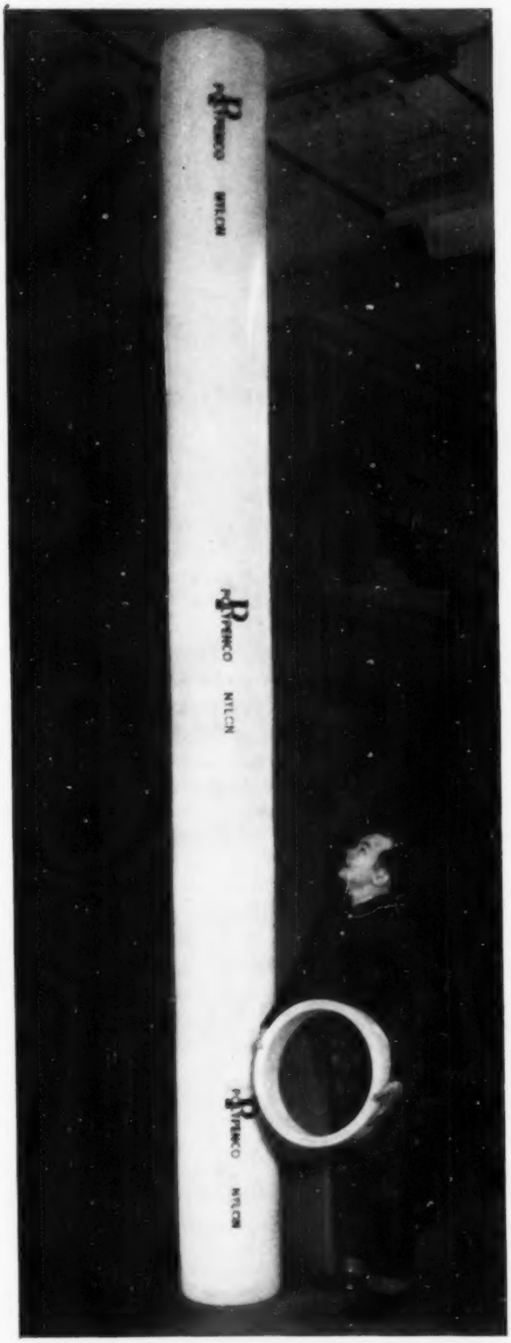
SLIP (coefficient of friction). Film samples are attached to the touching faces of two blocks, one fixed and one movable, the fixed block on top. The force required to restrain the fixed block is recorded as the movable block is dragged past it. The average value of this force is divided by the upper-block weight to get the coefficient of friction.

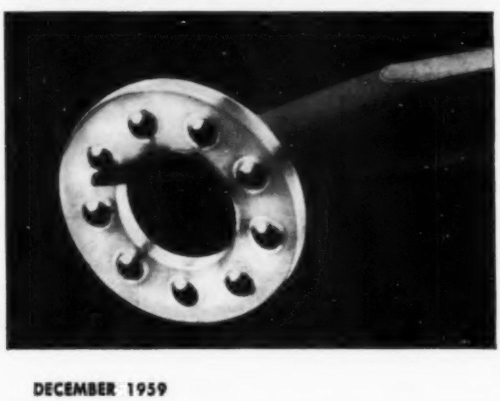
GLOSS is the amount of light reflected from a beam of light hitting the test surface at an angle of 60°. The reflected light is picked up by a photo electric cell at the same angle. A Gardner photo metric unit equipped with a gloss head is used in this determination. Values reported are for comparative purposes only and are *not* percentages.

HAZE is the amount of light which is deflected from a beam of light when passing through the film. The Gardner photo metric unit equipped with an integrating sphere is used for haze determinations. Values are reported in percent.

TEAR STRENGTH is defined as the amount of force necessary to tear a notched film sample. This is effected through the use of an Elmendorf tear tester. Results are reported as grams per mil thickness.

IMPACT STRENGTH is the amount of force necessary to puncture a given film sample. Results are reported as pounds per square inch and are obtained through the use of the Spencer impact tester (modified Elmendorf tear tester).





Photo, Allied Chemical Corp., National Aniline Div.

LOOKING through cured filament-wound structure at a cone-shaped electrical part being wound in a modified "figure 8" pattern. The box-like structure near center of photo contains the resin through which filaments are drawn before being wound on mandrel.

Filament winding—some basic principles

By Kenneth B. Turner*

Winding of strong fibers to form reinforced plastic structures with epoxy and polyester resins is an important process. Its use is increasing in missile, spacecraft, and other applications. A brief presentation is made here of the principles involved and problems encountered in winding continuous filaments on special equipment to form such items as lightweight pressure vessels.

The high strength-weight ratio of glass, ceramic, and some organic synthetic fibers has accounted for their use as reinforcement in plastic structures. Of the various methods used to produce strong, lightweight reinforced plastics structures, filament winding has several advantages, including the following:

First, the number of fiber crossings in a filament wound structure is relatively small. Second, crimping of the fibers at crossings is much less severe. Thirdly, the filaments can be oriented so that they carry loads along their strongest direction. These advantages along with low density and non-corrosiveness, recommend the use of wound plastic structures for missile and aircraft pressure vessels. As soon as the special techniques and equipment are further developed, very large items a hundred feet or more in length will probably be produced in the future because of the simplicity of the process.

*Project Engineer-Test Equipment, Guardite Co., Div. of American-Marietta Co., Wheeling, Illinois.

Principles

The basic geometric and kinematic principles used in filament winding are an extension of ideas originally developed for use in the textile industry. The reinforcing filaments are applied to a rotating form in the same manner that thread or yarn is applied to a textile serving cone. The simplest practical lay of filaments is a "figure 8" as shown by Fig. 1, p. 119. With this form of winding, a drive, *D*, rotates a forming mandrel, *M*, which pulls filaments, *F*, through a reciprocating transverse feed guide, *G*. Tension is controlled by friction fingers, *T*, and the filaments are supplied from source, *S*. The filament transverse rate back and forth across the winding mandrel, *M*, is such that the filament starting at Point 1 does not return to Point 1 after making the complete round trip. Instead, it ends its traverse at Point 2 or 3, which is about one strand width to either side of Point 1 where it started. If the ratio of the mandrel revolutions to the number of traverses is exactly 2:1, the winding operation will simply keep building up a figure 8 as shown in Fig. 2A, p. 119, and will not cover the mandrel as desired. If the ratio is slightly more or less than the integral 2:1 ratio, the winding strand will tend to cover the mandrel progressively as shown by Figs. 2B and 2C. After coverage is complete, additional winding will add further layers.

Longer vessels usually require modifications of this pattern. Examples of higher ratios of rotation to transverse motion are given in Fig. 3, p. 119. The number of pattern segments required in a given case depends upon the length of the structure and the desired filament crossing angle. For cylindrical pressure vessels, the hoop stress is theoretically twice the longitudinal stress. This calls for a winding angle of about 26½° with the axis to put the winding in pure tension. For cylindrical parts which will need to withstand bending stresses, the reinforcement would be applied at a

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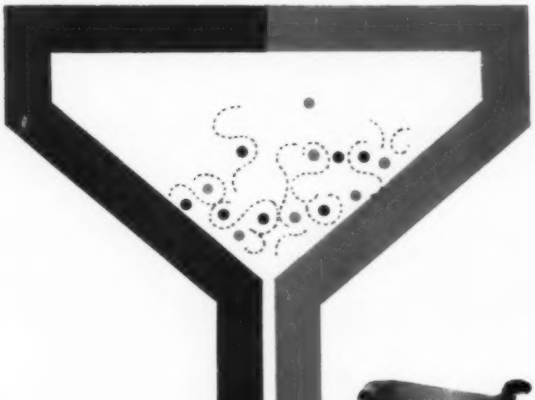

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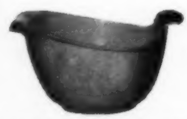

DEMONSTRATION AT MACY'S – Production of 5½-oz. mixing bowl in linear W. R. Grace's polyethylene shown in the store's houseware department on De Mattia fully hydraulic 4/6 oz. Model K-2 injection molding machine.

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smaller angle to the axis. Winding patterns can be modified to give optimum properties in the desired direction.

Configuration problems

Certain problems arise in applying certain configurations. If the required angle is steep or nearly parallel to the winding axis, the strand will tend to slip or turn, unless special precautions are taken. One solution is to slow the traverse action toward the end of each pass so that the angle is reduced at the end. This will work if the ends are later trimmed off so that the reduced angle area will not undermine the structure. Another method is to provide rings that the winding must climb at turn-around points. With this method, it is possible to design the ring as an integral part of the structure to be used as a means of attachment to adjacent parts. By wrapping over the ring and bonding to it with the resin, it is possible to add considerable safety factor to adhesive joints making interconnections to adjacent metal parts, also giving a minimum of stress concentration.

For steepest angles it is most practical to wind over the end of the mandrel so that the winding takes the form of a ball of twine or multiples of that pattern (see Fig. 4, p. 122). Disadvantages of this type of winding are that it does not give as closely regulated patterns as the previously described types, and calls for more exact relationships between mandrel and traverse mechanisms. Also the cured plastic structure must be cut from the mandrel, while the other types can be designed for push off.

Material limitations

Ideal winding conditions require the use of non-abrasive, dry filaments under constant tension. In actual practice filaments can be very abrasive on guide parts. This is especially true for dry glass or ceramic fibers. For such materials, guides should be made of hard alloys such as Stellite or carbides. It is also possible to use ceramic guides such as synthetic sapphire.

In many cases the filament will be wet as it is wound. Excess amounts of resin must be removed or the rotational winding speed must be reduced to prevent slinging the excess resin off the winding form. If the resin has been applied prior to reaching the traverse guide, handling is difficult unless the resin is in a viscous or more or less dry stage.

Constant tension can be roughly maintained with dry filaments by running at a constant speed through friction fingers, such as illustrated in Figure 1. Wet fibers, however, will gum and foul the friction fingers and fiber debris will accumulate. For wet application a tension reel and brake combination is needed. To avoid wet winding so that **(To page 122)**

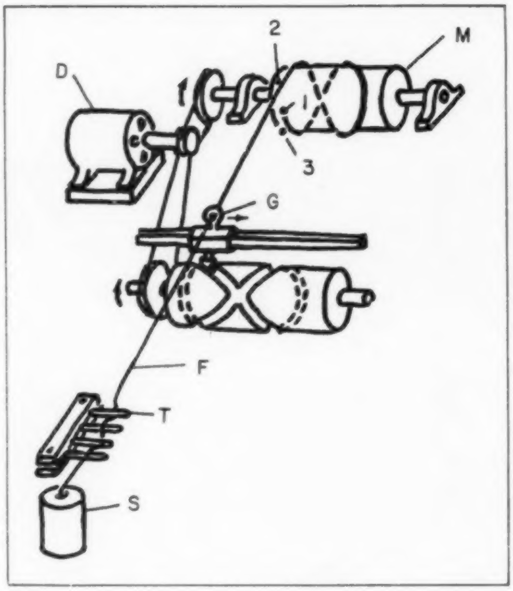


FIG. 1: Schematic drawing of a basic filament winding set-up; showing filament source and friction tensioner (S, T), filament (F), cam-follower guide (G), motor drive (D), and winding mandrel (M).

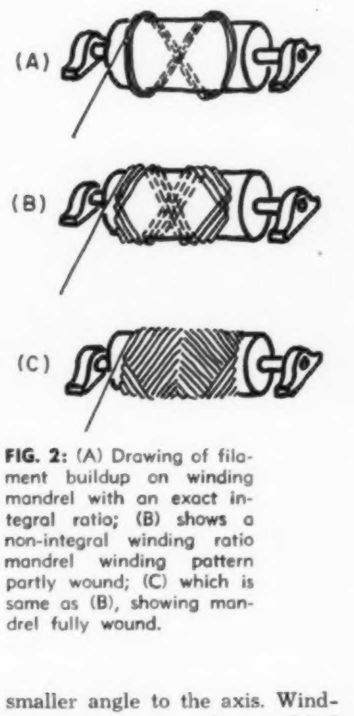


FIG. 2: (A) Drawing of filament buildup on winding mandrel with an exact integral ratio; (B) shows a non-integral winding ratio mandrel winding pattern partly wound; (C) which is same as (B), showing mandrel fully wound.

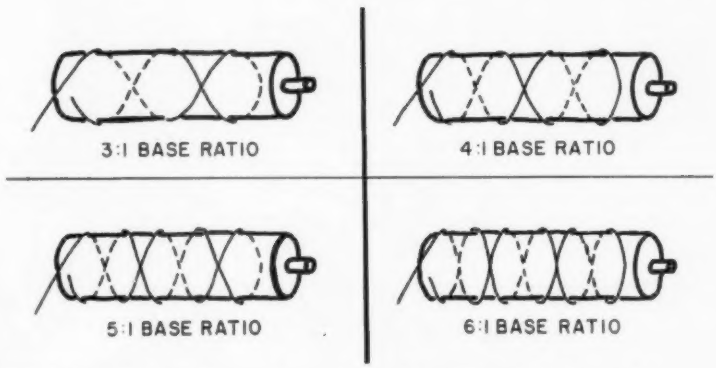
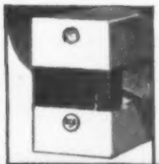


FIG 3: How different base ratios can be used for different winding angles.



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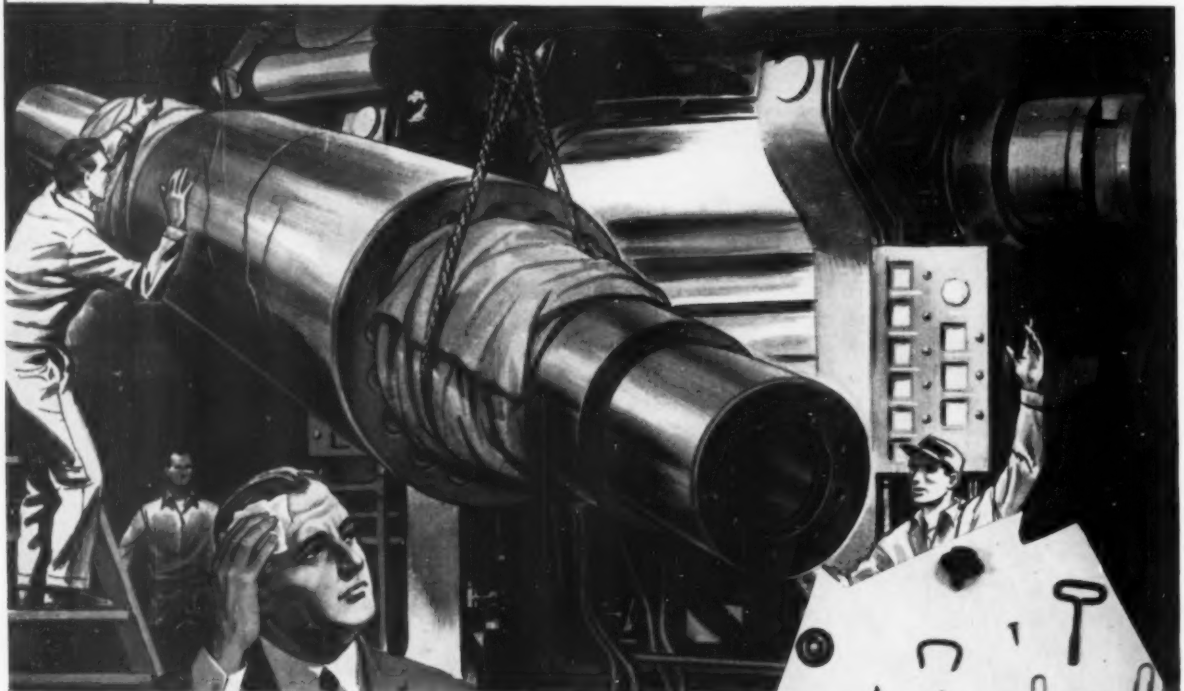

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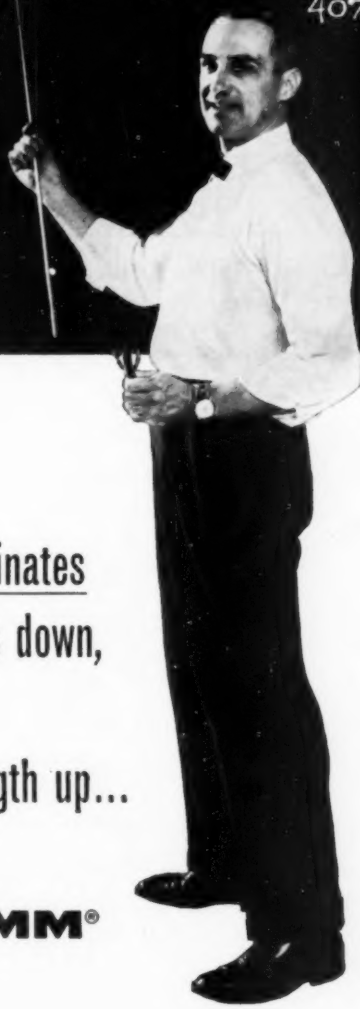
	28.5% Surfex MM	40% Surfex MM	50% Surfex MM	60% Surfex MM
Specific Gravity	1.76	1.80	1.87	1.95
Izod Impact, Ft. Lbs./In. Notch	14.4	16.2	17.3	16.5
Tensile Strength, psi	20,300	21,300	20,100	19,300
% Elongation	1.89	1.24	2.03	1.87
Modulus of Elasticity in Tension, psi x 10°	1.15	1.36	1.45	1.85
Flexural Strength, psi	33,150	33,600	37,800	37,000
Modulus of Elasticity in Flexure, psi x 10°	1.08	1.18	1.44	1.20
Barcol Hardness (10 sec. Reading)	55	57	62	66
Initial Viscosity of Mix	1,200	2,100	3,200	5,000
Fiber Glass Mat	40%	40%	33%	33%



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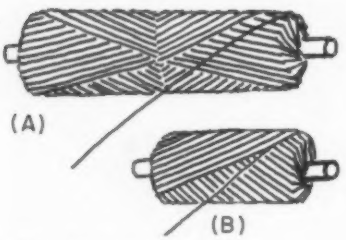


FIG. 4: Over-the-end ball type winding patterns showing (A) pattern obtained with a 2:1 base ratio; and (B), obtained with 1:1 base ratio.

simple tension devices can be used, one must apply the resin on the mandrel during winding or impregnate the finished winding afterward. Application at the mandrel can be achieved by using tangent doctor rolls on which the viscous resin is applied and which then transfer the resin to the dry material being wound. Post winding application can be done with vacuum and pressure equipment such as is used in the impregnation of electric coils. This latter process can be considered when production quantities justify the capital expense involved.

Achieving winding ratios

It is very important that the ratio of mandrel revolutions to traverses *not* be an exact integer. For example, if the width of the winding strand is approximately $1/200$ of the circumference of the wound article when the strand width is measured perpendicular to the winding axis, a proper ratio for a "figure 8" type of winding would be either 2.005 to 1 or 1.995 to 1. If either ratio is used succeeding strands on each complete traverse will lead or lag the preceding so that an overlapping identical "figure 8" pattern will not be made, and the strands will cover the mandrel progressively.

For experimental runs, the winding mandrel can be rotated by a constant speed synchronous motor. The traverse feed guide can be powered by a separate variable speed drive. In this manner the separate drives can be phased for the proper ratio during constant running conditions. However, they will get out of phase during startup and shutdown. A less flexible arrangement but one more satisfactory for maintaining winding patterns utilizes a power drive system consisting of timing belt, gears or chains, to obtain a constant traverse ratio.

In the case of production equipment it can be specifically designed for the various jobs it will have to do.

Reciprocating guide drives

In winding textile serving cones the following device is often used. The thread rides in a continuous "vee" groove cut in the surface of a plastic cylinder; going around it like a "figure 8". The groove traverses the thread back and forth across the winding cone. The fibers frequently used in reinforced plastic structures are generally too abrasive for this device. It is more advisable to use a cylindrical cam to drive a winding guide such as shown by Fig. 5, below. The cam follower, with filament guide, is designed long enough to bridge the cam intersections and is biconvex in shape to fit in the turn-around end groove. It is mounted ahead of its geometric center and faithfully follows the groove.

An alternate guiding device uses a horizontally mounted chain carrying a guide as shown in Fig. 6, below. The chain must be kept straight, which can be done by using idler supports at intervals along the chain. The winding guide should be free-swiveling, to keep it from fouling winding strand as it revises direction.

Other means of converting rotational motion to reciprocation may suggest themselves for particular projects. The important point is that the arrangement be rugged and trouble-free while being adaptable to setting and holding of the winding ratios.—**End**

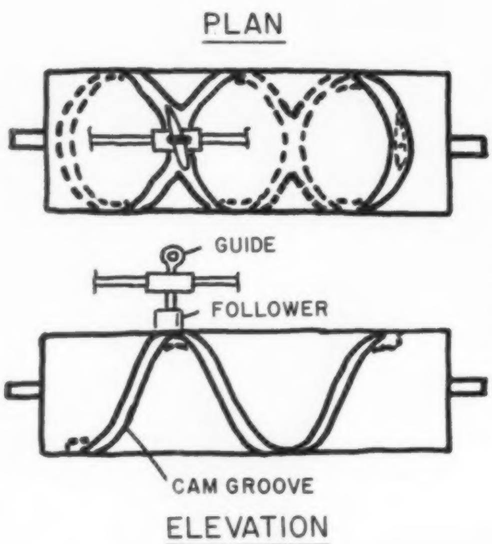


FIG. 5: Showing how a cylindrical cam can be used to develop the reciprocating traversing action, which is used for guiding the filament being wound.

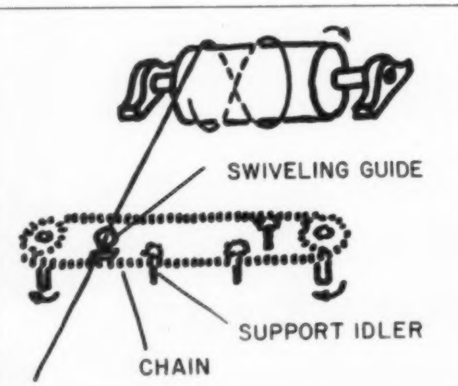
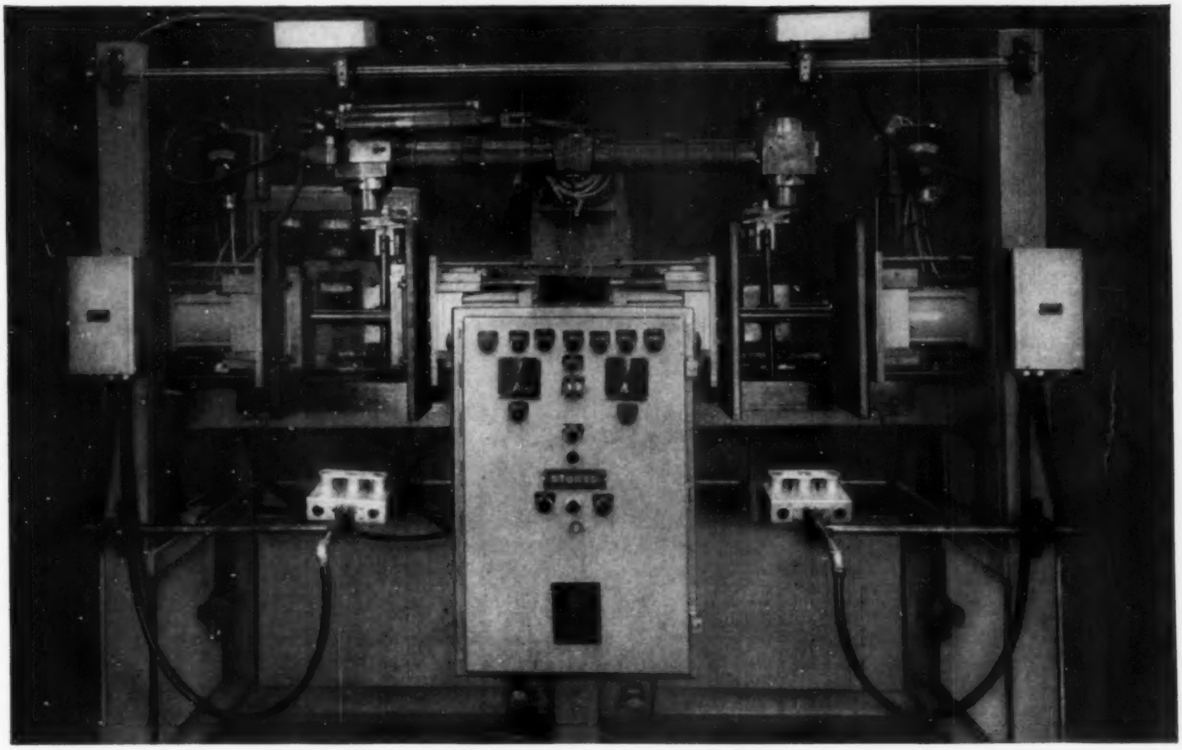


FIG. 6: Diagram of a chain drive used to develop the reciprocating traversing action of the filament guide.


STOKES

S.P.E. Technical Conference

Programs and papers to be presented at the 16th annual meeting

The 16th Annual Technical Conference of the Society of Plastics Engineers will be held January 12-15, 1960 at the Conrad-Hilton Hotel in Chicago, Ill.

At noon on Wednesday, a membership meeting and annual business session will be held. There will be an Education Committee Luncheon on Tuesday. On Thursday evening, there will be a banquet for the members. The tentative program follows:

Tuesday morning, Jan. 12

Session 1: Polymer structure. *Moderator: Robert R. Stromberg, National Bureau of Standards, U. S. Department of Commerce.*

"Calculation of melting and freezing rates (Delrin Acetal Resin)." *P. N. Richardson, E. I. du Pont de Nemours & Co.*

"Thermo and Shear Degradation of Polyethylene Melts." *H. Schott and W. S. Kaghan, Olin Mathieson Chemical Corp.*

"A Statisitcal Study of the Effect of Formulation Variables on the Properties of Sorbitol Polyether-Based Rigid Urethane Foam." *J. E. Wilson, H. M. Truax, and M. A. Dunn, Atlas Powder.*

"The Effect of Molecular Weight Distribution on the Flow Properties of Polyethylene." *D. R. Mills, G. E. Moore, and D. W. Pugh, U. S. Industrial Chemicals Co.*

Session 2: Physical properties. *Moderator: Dr. Ed T. Sievers, American Viscose Corp.*

"Relations Between Physical Properties and Molecular Structure of Polypropylenes." *N. H. Shearer Jr., J. E. Guillet, H. W. Coover Jr., Tennessee Eastman.*

"The Measurement of Polyethylene Degradation by ZST Test." *T. H. Meltzer and John J. Muldrew, Electric Storage Battery Co.*

"Environmental Stress Rupture of Polyethylene." *L. L. Lander, Union Carbide Plastics Co.*

"Working Stress Limits for Thermoplastic Structural Components." *W. D. Harris, Dow Chemical Co.*

Session 3: Blow molding. *Moderator: G. S. Brown, Plax Corp.*

"Extrusion Blow Molding Techniques for High-Density Polyolefins." *Robert Doyle, D. E. Perry, and T. E. Branscum, Phillips Chemical Co.*

"The Blow Molding of Cellulosic Plastics." *D. A. Jones and R. J. Haughwout, Celanese Corp. of America.*

"Blow Molding." *W. O. Bracken, Hercules Powder Co.*

Session 4: Fabricating and finishing. *Moderator: Jerome Formo, Minneapolis-Honeywell Regulator.*

"Post Molding Operations on Acetal Resins. *R. L. Miller, E. I. du Pont de Nemours & Co.*

"Vacuum Metallizing as Related to Plastics." *T. J. LaBounty, Midwest Technical Service.*

"Method for Determination of the Effect of Annealing on Residual Molding Stresses." *L. B. Allen, International Business Machines Corp.*

Session 5: Casting and plastics tooling. *Moderator: Lawrence Whitman, L. Whitman & Co.*

"A Heat Conductive Epoxy Formulation for Low Cost Molds." *R. T. O'Connor and H. J. White, Devcon Plastic Steel Corp.*

"Plastics Tooling for Plastics Production." *Frank L. Bogart, Marblette Corp.*

"The Manufacture of Large Reinforced Plastic Molds for Hand Layup." *E. P. Weaver, Atlantic Marine Industries Inc.*

Wednesday morning, Jan. 13

Session 6: Injection molding, Part I. *Moderator: Bennett Nathanson, Monsanto Chemical Co.*

"The Effect of Orientation on the Physical Properties of Injection Moldings." *G. B. Jackson and R. L. Ballman, Monsanto Chemical Co.*

"Design Considerations for Molded Polyolefin Items." *J. N. Scott, J. V. Smith, and D. Alexander, Phillips Chemical Co.*

"Insert Molding with High-Density Polyethylene." *W. L. Price and W. A. Hunter, Celanese Corp. of America.*

"An Analysis of Injection Mold Filling of Polyethylene." *R. B. Staub, Union Carbide Plastics Co.*

Session 7: Extrusion, Part I. *Moderator: George P. Kovach, Foster-Grant Co.*

"Pressure Development in Extruder Screws." *B. H. Maddock, Union Carbide Plastics Co.*

"Monofilament Tester."*J. P. Fogerty and J. J. Whidden, W. R. Grace & Co.*

"The Chill Roll Extrusion of Polypropylene Film." *G. C. Calderwood, Spencer Chemical Co.*

"Rapid Response Recording of Extrudate Temperature and Pressure—Typical Use in Evaluating Extruder Performance." *H. B. Kessler, R. N. Bonner, C. F. W. Wolf, P. H. Squires, Du Pont.*

Session 8: Reinforced plastics. *Moderator: R. White, Glastic Corp.*

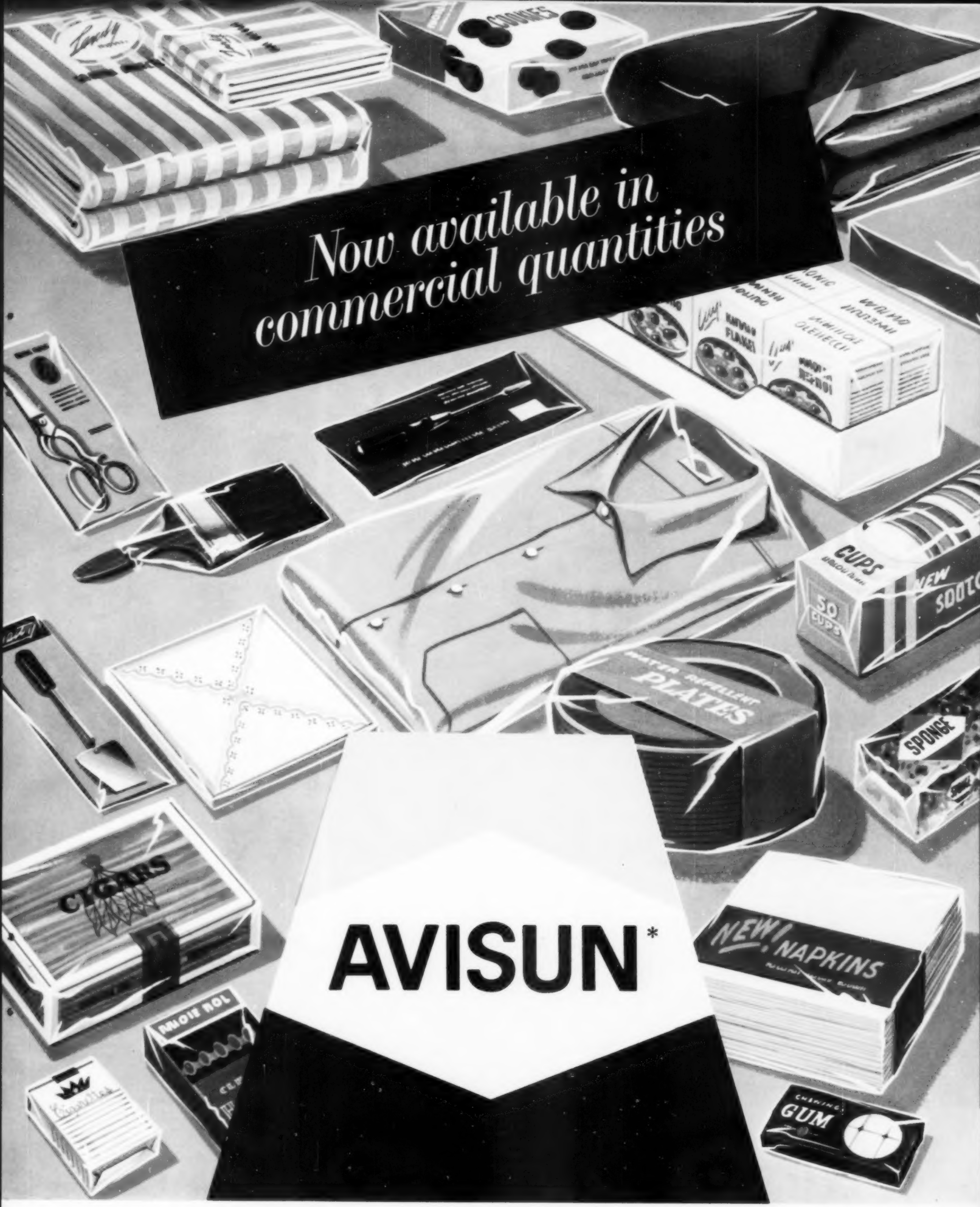
"The Experimental Determination of Panel Shear Strength and Modulus of Rigidity for Glass Reinforced Plastic Laminates." *A. P. Penton III, Convair.*

"Heat Resistant Inorganic Fabric Reinforced Plastic Laminate." *John Miglarese, Westinghouse Electric Corp.*

"Polyester Resin Evaluation for Long-Term Wet Strength Retention." *C. E. Loetel, The Marley Co.*

"High Temperature Epoxy Resin Laminates." *R. O. Menard and W. W. Cooner, Du Pont.*

Session 9: Standards for reporting properties. **(To page 129)**



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AVISUN

Thermosetting Molding. *Moderator: Elias G. Greninger, The Bryant Electric Co.*

"Melt Index Equivalent—A New Flow Parameter." *P. J. Boeke, R. J. Martinovich, and R. A. McCord, Phillips Chemical Co.*

"Effects of Thermal History on Some Properties of Polyethylene." *John B. Howard and William M. Martin, Bell Telephone Laboratories Inc.*

"Preform Hardness vs. R. F. Preheat Time and Temperature of Phenolic Molding Materials." *E. W. Vaill, Union Carbide Plastics Co.*

"Cure of Molded Melamine Resin and Its Significance for Properties." *H. P. Wohnsiedler and R. A. Tiley, American Cyanamid Co.*

Wednesday afternoon, Jan. 13

Session 10: Plastics in electrical insulation. *Moderator: Walter A. Gammel Sr., Automatic Process Control.*

"Effect of Humidity on Surface Resistance of Filled Epoxy Resins." *L. S. Buchoff and C. H. Botjer, Electro Tec Corp.*

"Modified Alkyd Molding Compounds." *J. J. Moylan and P. D. Sullivan, Allied Chemical Corp.*

"Low Loss Casting Resins." *William R. Cuming, Emerson & Cuming Inc.*

Session 11: Packaging. *Moderator: J. R. Akers, Union Carbide Plastics Co.*

"A New Test for Polyethylene Printability—The Inclining Platform Tester." *T. F. McLaughlin Jr., E. I. du Pont de Nemours & Co.*

"Design and Production Considerations for Thin Wall Formed Containers." *J. R. Lynch, Dow Chemical Co.*

"Machine Design, Adaptations and Problems of Poly Film Overwrap Machines." *Boyd Redner Jr., Battle Creek Packaging Machines Inc.*

Session 12: Vinyl plastics, Part I. *Moderator: Robert Bostwick, Union Carbide Plastics Co.*

"The Mechanism of Poly (Vinyl Chloride) Stabilization by Barium, Cadmium, and Zinc Carboxylates." *A. H. Frye and R. W. Horst, The Carlisle Chemical Works.*

"Color Stability of Vinyl Compounds Pigmented with Iron Oxides." *A. K. Woernle, C. K. Williams & Co.*

"The Food Additive Amendment and Packaging Material." *A. J. Lehman, Food and Drug Adm., U. S. Dept. of Health, Education and Welfare.*

"Polyvinyl Chloride Adhesion to Synthetic Fabric." *C. F. Blaich Jr. and A. J. Sampson, The Carwin Co.*

Thursday morning, Jan. 14

Session 13: Injection molding, Part II. *Moderator: Bennett Nathanson, Monsanto Chemical Co.*

"Some Causes and Cures of Splash Defects in Acrylic Molding." *S. E. Giragosian and G. C. Freygang, Rohm & Haas Co.*

"Factors Affecting Toughness, Serviceability of High-Density Polyethylene Items." *J. N. Scott, D. Jones, and P. J. Boeke, Phillips Chemical Co.*

"The Effect of Molding Conditions on Physical Properties of Polyethylene." *W. A. Dunlap, P. J. Meeks, and W. T. Wickham, Dow Chemical Co.*

"Flow of Escon Polypropylene in Injection Molding." *W. E. Heumann, Enjay Laboratories.*

Session 14: Extrusion, Part II. *Moderator: Don Williams, former Pres., Chippewa Plastics.*

"Extrusion: Described by Experimentally Determined Equations." *H. J. Donald, J. K. Rieke, and E. S. Humes, Dow Chemical.*

"Techniques in the Extrusion of High Density Polyethylene Tubing and Profiles." *D. J. Schmidt, W. R. Grace & Co.*

"Flow Patterns in a Single-Screw Extruder." *W. D. Mohr, P. H. Squires, and F. C. Starr, E. I. du Pont de Nemours & Co.*

"Sucrose Acetate Isobutyrate in Cellulose Acetate Extrusions." *E. W. Wilson and William M. Gearhart, Eastman Chemical Products Inc.*

Session 15: New Materials, Part I. *Moderator: Dr. Clayton J. Ammondson, Continental Can Co. Inc.*

"Properties of Intermediate Density Copolymers of Ethylene." *S. P. Foster, E. T. Pieski, and S. H. Jenkins Jr., E. I. du Pont de Nemours & Co.*

"Knowing and Recognizing Quality in Fabricated Teflon." *P. E. Thomas, Du Pont.*

"Ethylene Copolymers." *P. J. Boeke, R. J. Martinovich, and J. E. Pritchard, Phillips Chemical Co.*

"A New Resin for Plastic and Coating Applications." *J. E. Guillet and H. W. Coover Jr., Tennessee Eastman Co.*

Session 16: Vinyl plastics, Part II. *Moderator: Walter Wayckoff, Monsanto Chemical Co.*

"Characterization of Poly (Vinyl Chloride) Resins by the Conductivity of Solvent Extract." *J. B. DeCoste, Bell Telephone Labs; and B. A. Stiratelli, B. F. Goodrich Chemical Co.*

"The Use of Ditridecyl Phthalate in Polyvinyl Chloride Formulations." *W. A. Dimler, J. A. Mountain, and W. F. Overberger, Enjay Laboratories.*

"Determination of Plasticizer Compatibility by Swelling Measurements." *A. C. Hecker and N. L. Perry, Argus Chemical Co.*

"Acrylic Polymers for Use in Rigid and Semi-Rigid Vinyl Compounds." *R. P. Hopkins, Rohm & Haas Co.*

Thursday afternoon, Jan. 14

Session 17: Mold design. *Moderator: John Andras, General American Transportation Corp.*

"Precision Geometrical Blending in Molds for Plastic Parts." *W. D. Evans.*

"Thermal Considerations in the Design of Equipment for the High Pressure Molding of Plastics." *W. J. Stokes, Stokes-Trenton Inc.*

"Mold Design for Improved Cycling." *R. L. Beesley, L. W. Meyer, and J. W. Mighton, Dow Chemical Co.*

Session 18: Forming. *Moderator: D. P. Meiklejohn, Monsanto Chemical Co.*

"Designing Ther- **(To page 179)**

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Dr. Gordon M. Kline, Technical Editor

PLASTICS* TECHNICAL SECTION

MATERIALS • PROPERTIES • TESTING METHODS AND INSTRUMENTATION • STANDARDS • CHEMISTRY

Chemical structure and stability relationships in polymers

By B. G. Achhammer†, Max Tryon†, and G. M. Kline†

Laboratory aging tests have been developed to evaluate polymer degradation, but in most cases these methods are limited to a relative comparison of materials under the specific conditions of a given test environment. Although these tests serve an immediate need for technical evaluation of polymers, it is recognized that more basic methods are required. A possible approach to these new methods is through an expanding knowledge of stability relationships between polymer structure and various environmental parameters. A review of our present knowledge in terms of a number of these parameters, including thermal, ultra-violet, and nuclear radiant energy, oxygen, water, and various climatic environments, is presented in this paper. Techniques used in such investigations to identify structural changes are also briefly surveyed in this article.

Stability of polymers is usually considered in terms of a material's ability to withstand specified conditions and still retain the physical properties required for use of the material in a given application. Admitting that the retention of desired physical properties is a matter of practical concern, it is necessary to recognize the basic problem in stability of polymers as being degradation of a chemical structure involving environment and available energy. Resultant changes in chemical structure then determine the material's physical properties.

The chemical process of degradation of polymers results in changes on a molecular scale that may be described by several broad types of reactions (1)[1] as follows: 1) chain scission, 2) cross-linking, 3) modifications of the chemical structure of the polymer chain, 4) modifications of side groups, and 5) combination of these reactions. Variations in environmental conditions may change the relative extent of these reactions in a given material from time to time (2-5). In most cases the degradation processes are essentially reactions in which radicals are the active intermediates (4). The resultant effect on a polymer may be hardening due to cross-linking, cyclization, or further polymerization, or softening or tackiness due to chain scission and depolymerization. The relative rates of these concomitant reactions of cross-linking and scission will determine, in most cases, the ultimate effect on physical properties (2). Degradation reactions of polymers induced by both physical and chemical means have been treated comprehensively by Grassie (6) and his book has provided considerable background for this discussion of the relationships between chemical structure and stability of polymers.

Methods of evaluating chemical changes

Rapid advances in polymer chemistry have been made possible by recent important developments in instrumental techniques. The polymer chemist depends greatly on these tools to unravel the difficult problems unique to the field of polymer chemistry (7).

Among the modern tools used in polymer degradation studies are those particularly suited to functional group analysis. These include the absorption spectrometric methods in the ultra-violet and infra-red regions. Of these two ap-

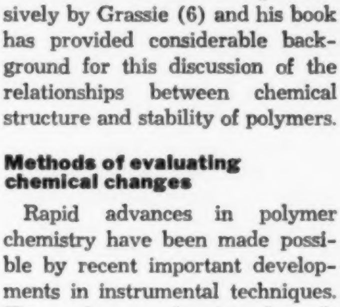


FIG. 1: Energy of light radiation at various wavelengths (from Ref. 40).

*Reg. U. S. Pat. Off.

†National Bureau of Standards, Washington, D. C.

[1]Numbers in parentheses link to references at end of article, p. 222.

Paper presented at the Symposium on Aging of Plastics, held in Dusseldorf, Germany, on Oct. 19, 1959, under the auspices of the Division of Plastics and High Polymers of the International Union of Pure and Applied Chemistry. This paper is from the periodical *Kunststoffe*, combined with *German Plastics Digest*, No. 11, 1959, published by Carl Hanser Zeitschriftenverlag, Munchen, in which the complete proceedings of the symposium are published.

proaches, infra-red absorption spectrometry is the more valuable for functional group analysis due to its greater specificity. The work of Thompson and Torkington (8), Sutherland (9), Krimm (10), and many others on the determination of the structure of polymers using absorption in the infra-red is well known. Infra-red techniques have also been used in degradation studies to determine the mechanism of these reactions (11, 12). Ultra-violet absorption spectrometry is more useful for determining reaction rates than for functional group analysis. The work of Tryon (13) and Ford (14) serve as examples.

Another useful technique in degradation studies is mass spectrometric analysis of volatile fragments generated from the polymer during degradation. This technique has been used by Madorsky (15), Wall (16), Achhammer et al. (17), and many others. Current work in gas-liquid chromatography gives promise of assisting in the study of volatile products of degradation. This tool lends itself particularly well to the separation and identification of many of the products, such as water (18), for which the mass spectrometer is unsuited. Electron spin resonance can be used to determine free radical concentration in polymers (19). Deuteration of polymers is another useful technique (20).

The use of radioactive "tags" on the polymer, such as C^{14}, H^{3}, O^{18}, etc. has not been applied extensively to degradation studies. S^{35} has been used in numerous studies of vulcanization reaction with rubber (21), and other radioactive isotopes have been used in studies of permeability of membranes of various polymers (22). This is a powerful tool for the identification of structural changes which needs further exploration and use.

Chemical methods for functional group analysis include titration for free acid or basic groups, end group analysis, ozonolysis plus chemical identification and quantitative analysis of products, and titration of double bonds, as well as many other specific and non-specific tests.

Changes in molecular weights of polymers as a result of degradation (chain scission and/or cross-linking) may be studied by a variety of techniques. Soluble polymers may be characterized in terms of viscosity, osmotic pressure, sedimentation, light scattering, and the like of their dilute solutions. Insoluble polymer may be roughly characterized by swelling index. A book is currently in preparation which deals with these various analytical methods for polymers (23).

Table I: Bond energies (References 24, 25)

Bond		*Bond energy kcal./mole*
C≡N	(nitrile)	209
C≡C		200
C=O		174
C=C		145
C=S		129
C–C	(aromatic)	124
C–H	(acetylene)	121
C–F		119
O–H		110
C–H	(ethylene)	106
C–H	(methane)	98
Si–O		89
C–O		87
S–H		87
N–H		84
C–C	(aliphatic)	80
C–O	(ether)	79
C–Cl		78
S=S		76
Si–H		75
Si–C		70
C–N	(nitromethane)	68
C–S		66
O–O	(peroxide)	64
N–N	(hydrazine)	37

Thermal radiant energy

Some thermal effects on polymers, such as melting and glass transitions, are reversible physical properties of the polymer. Heat may also produce irreversible or permanent chemical changes in the polymer.

The heat stability of a polymer in the absence of other active substances is related to the dissociation energies of its various chemical linkages. Representative values for the dissociation energies of common chemical bonds (24, 25) are presented in Table I, above. These bond energies were determined on studies of small molecules. Interactions in a high molecular weight material may exert a considerable effect on the stability of a given bond under a specific set of conditions.

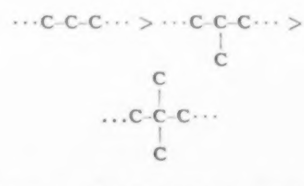
Thermal stability of a polymer is frequently studied under pyrolytic conditions. In this case sufficient energy is added to rupture primary valence bonds in the polymer. Most of the characteristics of the decomposition result from basic structure of the polymer and not trace impurities, although the magnitude of the rates and activation energies are sensitive to trace structures or impurities (26). The initial decrease in molecular weight of a polymer when it is heated may be due to weak structures in the polymer (27).

Madorsky et al. (28-31d) have conducted extensive studies of the pyrolysis of polymers at temperatures up to 500° C. (Table II, p. 134). Some polymers, such as poly-alpha-methylstyrene, break down to give only monomer when pyrolyzed at temperatures of about 200 to 500° C. Other polymers, for example polymethylene, evolve a whole spectrum generally containing from 2 to 50 carbon atoms. Polyisobutylene yields partly monomer and partly large fragments. The rates of formation of those fragments and their vaporization can be correlated with the chemical structure of the polymers, including both backbone and side group structure.

Although there is disagreement among investigators in regard to numerical values of bond strengths, it is possible to obtain general agreement on their relative strengths. The following order[2] of bond stability has been suggested (29), and was based on pyrolysis studies on polymers :

C-F > C-H > C-Cl > C-C

The observed relative strengths of various C-C bonds in the main chain (28) are as follows:



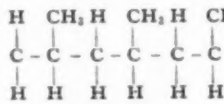
Thus, bonds adjacent to a quaternary or tertiary carbon in the chain are more susceptible to

[2]Because of a typographical error, the C-Cl is listed in the original reference as being more stable than the C-C bond.

cleavage. A C-C bond beta to a double bond in a chain or in its side group is also a source of relative weakness in the chain.

Rates of volatilization can be used to compare thermal stability of polymers (29) as shown in Table II. To make this comparison, the rates of volatilization at 350° C. (K_{350}) were calculated for all the polymers studied. The T_h value of Table II is the temperature at which the polymer loses half its weight when heated in a vacuum for 30 min. at this temperature preceded by a 5-min. period of heating-up to this temperature.

Polytetrafluoroethylene appears as the most thermally stable polymer in the list in Table II. The phenylene group is believed to impart stability to the next two most stable materials, poly-p-xylylene and polybenzyl. Polymethylene, polyethylene, and polypropylene follow in that order; their stability is apparently related to branching of the molecule and the type of hydrogen bond available. Carbon-carbon bond strengths decrease from primary to tertiary (32); polypropylene has a branched structure which results in an abundance of tertiary carbons as follows:



Secondary hydrogen is accepted as being relatively more stable than

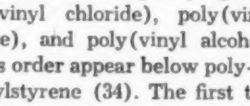
Table II: Thermal degradation data for polymers (Ref. 28-31d)

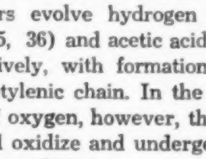
Polymer	*Structure*	*T_h*[1] °C.	*K_{350}*[2] %/min.	*E*[3] kcal./mole	*Monomer yield* %
Polytetrafluoroethylene	$-CF_2CF_2-$	509	0.000002	81	>95
Poly-p-xylylene	$-CH_2C_6H_4CH_2-$	432	0.002	73	0
Polybenzyl	$-C_6H_4CH_2-$	430	0.006	50	0
Polymethylene	$-CH_2-$	414	0.004	72	< 0.1
Polytrifluoroethylene	$-CF_2CHF-$	412	0.017	53	0
Polybutadiene	$-CH_2CH{=}CHCH_2-$	407	0.022	62	2
Polyethylene, branched	$-CH_2CH_2-$	404	0.008	63	< 0.1
Polypropylene	$-CH_2CH-$ CH_3	387	0.069	58	< 0.2
Polychlorotrifluoroethylene	$-CF_2CFCl-$	380	0.044	57	27
Poly-β-deuterostyrene	$-CHDCH-$ C_6H_5	372	0.14	56	39
Polyvinylcyclohexane	$-CH_2CH-$ C_6H_{11}	369	0.45	49	0.1
Polystyrene	$-CH_2CH-$ C_6H_5	364	0.24	55	40
Poly-α-deuterostyrene	$-CH_2CD-$ C_6H_5	362	0.27	55	68
Poly-m-methylstyrene	$-CH_2CH-$ $C_6H_4CH_3$	358	0.90	56	45
Polyisobutylene	$-CH_2C(CH_3)_2-$	348	2.7	49	20
Poly(ethylene oxide)	$-CH_2CH_2O-$	345	2.1	46	4
Poly-α, β, β-trifluorostyrene	$-CF_2CF-$ C_6H_5	342	2.4	64	74
Poly(methyl acrylate)	$-CH_2CH-$ $COOCH_3$	328	10	34	0
Poly(methyl methacrylate)	$-CH_2C(CH_3)-$ $COOCH_3$	327	5.2	52	>95
Poly(propylene oxide), isotactic	$-CH_2CHO-$ CH_3	313	20	35	1
Poly(propylene oxide), atactic	—	295	5	20	0.6
Poly-α-methylstyrene	$-CH_2C(CH_3)-$ C_6H_5	286	228	55	>95
Poly(vinyl acetate)	$-CH_2CH-$ $OCOCH_3$	269	—	17	0
Poly(vinyl alcohol)	$-CH_2CH-$ OH	268	—	—	0
Poly(vinyl chloride)	$-CH_2CHCl-$	260[4]	170[4]	32	0

[1]Temperature at which polymer loses half its weight when heated in a vacuum for 30 min. preceded by a 5-min. period of heating-up to this temperature. [2]Rate of volatilization at 350° C. [3]Activation energy of degradation reaction. [4]Based on loss of HCl (Ref. 35).

tertiary hydrogen and it is, therefore, not surprising that polymethylene is observed to be more stable than polypropylene. The intermediate position of the branched polyethylene may be a result of the presence of some tertiary hydrogens. Polystyrene has every bond in the chain in a beta-position to a phenyl group in addition to every other carbon being of the tertiary type. In polyvinylcyclohexane every other carbon is tertiary and an abundance of hydrogen is available for transfer. Polyisobutylene and poly-(methyl methacrylate) have very high rates of decomposition into volatile fragments, most likely as a result of both having every other carbon in the chain of the quaternary type. It has been observed (33) that cross-linking does not change the degradation characteristics of poly(methyl methacrylate). Stability is further reduced in poly-alpha-methylstyrene where in addition to every other carbon in the chain being of the quaternary type, every bond in the chain is beta to a phenyl group. Poly(vinyl chloride), poly(vinyl acetate), and poly(vinyl alcohol) in this order appear below poly-α-methylstyrene (34). The first two polymers evolve hydrogen chloride (35, 36) and acetic acid (37), respectively, with formation of a polyacetylenic chain. In the presence of oxygen, however, the latter will oxidize and undergo further degradation.

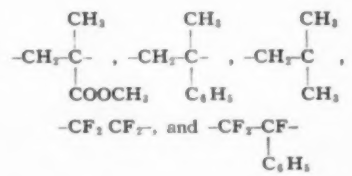
The pyrolytic degradation of vinyl polymers is generally recognized as a free-radical chain mechanism, involving the basic steps of initiation, propagation, transfer and termination (38). It has been observed (16) that the reactivity of a free radical depends on its structure. Taking this premise a step further, the activation energies for the removal of a hydrogen by radicals should increase in the following order:





For the three types of radicals on the right, there is no theoretical basis for readily predicting the exact order of reactivity; however, it is certain that these radicals are quite unreactive compared to the radical RCH_2.

Qualitatively, molecular structures that are favorable for transfer reactions, either inter or intra, provide opportunities for forming nonmonomeric material and should, therefore, reduce monomer yield (39). Tertiary hydrogen atoms and chlorine atoms are especially readily removed in transfer reactions. Transfer will be favored by active radicals and will be less likely with resonance-stabilized or sterically hindered radicals. Higher monomer yields are shown in the data in Table II for polymers that are devoid of tertiary hydrogens, such as those having these structures:



The lower monomer yield of polychlorotrifluoroethylene is considered to be related to the vulnerability of the Cl atom to transfer. The styrene polymers all show relatively high monomer yields; although transfer is favored by the tertiary hydrogens present in most of these polymers, it is presumably lessened because of the relatively stable radicals that are necessarily involved.

Polymers of the aliphatic hydrocarbon class all show relatively low monomer yields even when tertiary hydrogen is absent; the activity of the alkyl free radicals appears to compensate for the lack of tertiary hydrogens. In general, with the exception of polytetrafluoroethylene, high temperature of decomposition is associated with low monomer yield, which is due to more transfer.

Ultra-violet radiant energy

Photochemical reactions occur as a result of absorption of radiant energy of light by chemical structures. Sunlight is a major source of radiant energy; it would be a much more serious factor in degradation of materials except that most of the short wavelengths emitted are absorbed in the earth's atmosphere. The wavelengths of sunlight available at the earth's surface that cause the most degradation of polymers (oxidation, chain scission, and cross-linking) are in the ultra-violet range of 3000 to 4000 Å.; only about 5% of the total sunlight at the earth's surface falls in this category.

The energy of ultra-violet light depends on its wavelength (Fig. 1, p. 131). At 3500 Å. this energy is 82 kcal./mole. This is sufficient to break many bonds in polymers since the energy required to break a bond between atoms in a molecule, based on studies of small organic molecules, is known to range from 50 to 100 kcal./mole (Table I).

When a molecule absorbs ultra-violet energy, it becomes temporarily (frequently less than a ten-billionth of a second) highly activated or electronically excited. The excited molecule may transfer its absorbed energy to another molecule during collision or may re-emit it at longer wavelengths; the released energy is dissipated as fluorescence, phosphorescence, or heat. However, in some instances the excited molecule initiates a photochemical reaction, involving itself and sometimes neighboring molecules. The energy per quantum, or intensity of radiation, rather than the total amount of radiant energy determines activation and reaction (40-43).

Plastics can be protected against degradation by photochemical reactions by the addition of compounds that preferentially absorb ultra-violet light, re-emitting this energy at nondestructive wavelengths. Strong absorption in the ultra-violet region of 3000 to 4000 Å. is a primary requisite of such stabilizers. Ultra-violet absorbers commonly in use can be classified (40) by chemical structure as salicylic esters (absorb up to 3400 Å.), benzotriazoles (absorb up to 3800 Å.), and hydroxybenzophenones (2-hydroxybenzophenones absorb up to 3700 Å. and 2,2'-dihydroxybenzophenones up to 4000 Å.). In order for radiant energy to initiate reactions, it must first be (To page 139)

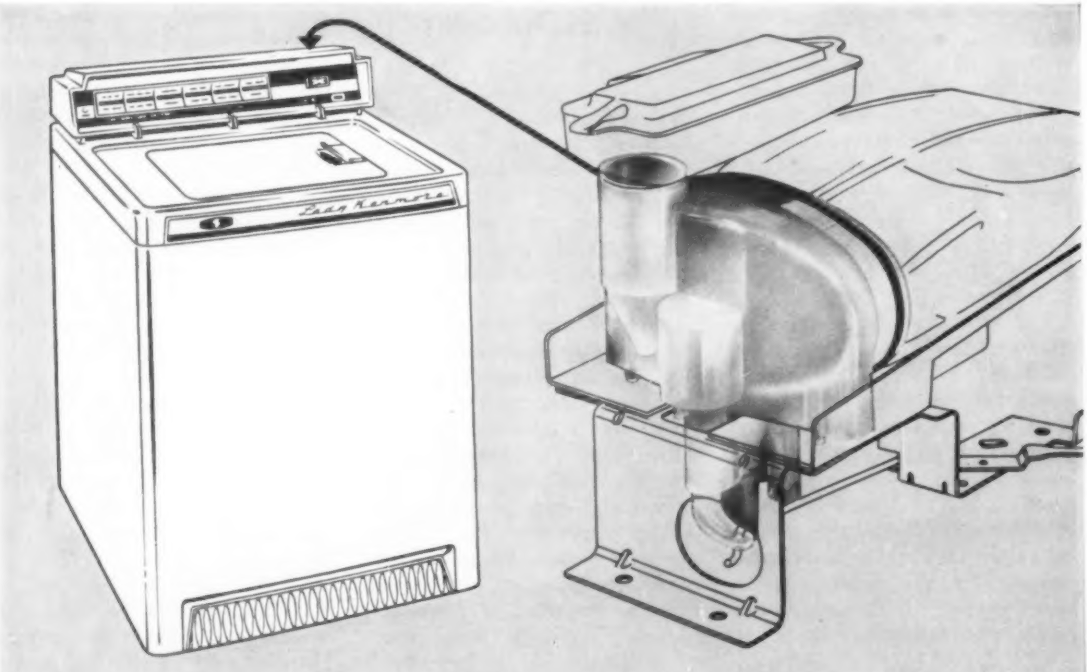
HERCULES

Plastics Hi-lites

Hidden values with new plastics

The inside story of seldom-seen parts performing demanding roles in new equipment

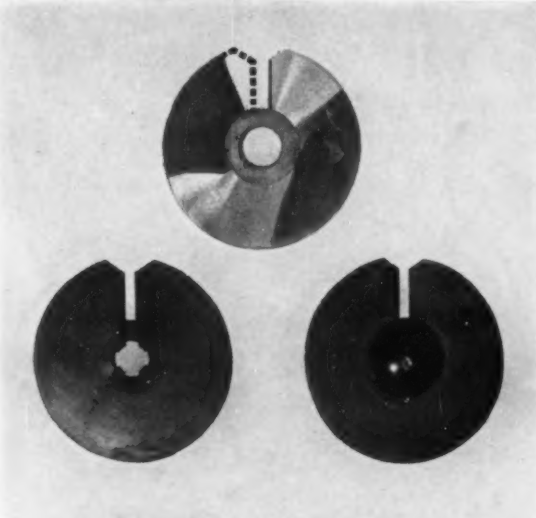
Today's consumer is prone to take advanced engineering features of new products for granted. Industrial users, too, have come to expect superior performance and greater serviceability from every piece of new equipment. Here are a few of the ways that design engineers are using Hercules new plastics to build added values into their products without increased cost. Able to work for the first time with thermo-plastics which are truly structural materials, they have found it possible to make one part do the work of many. Rapid-cycle injection molding produces the new precision-formed units at low cost, and the properties of the new materials provide the stamina and durability which assure faithful, trouble-free service.



Handsome styling, luxurious appointments, and its many extra service features have made the Lady Kenmore Clothes Washer one of the nation's best sellers. But it's the engineering and quality of construction inside the Lady Kenmore which enables Sears to maintain its reputation for *big value* merchandise. A significant example is the advanced design of the rinse dispenser developed by The Dole Valve Company, Morton Grove, Illinois, especially for this outstanding machine. The heart of the unit (shown in position in the diagram with the rest of the assembly in outline) is precision molded with Pro-fax®, Hercules' polypropylene. Pro-fax, the newest and most versatile of thermoplastic, provides a part that is immune to rust and the corrosive attack of detergents, highly resistant to heat, mechanically strong, and functionally sound.

How a one-piece Penton® Part replaced five individual parts

When Economics Laboratory, Inc. developed its new Drymaster*—a proportionate pumping system to automatically dispense its nationally known line of chemical formulations for commercial dishwashing—it faced the problem of finding a material to replace its conventional 5-piece bronze disc and carbon half-ball assembly. Failures in the Drymaster after only a few months of service were directly traced to wear of the disc and half-ball, and Economics Laboratory thoroughly evaluated more than 150 materials before selecting Penton®. The success of Penton in the



Here's dramatic evidence of Penton's superior wear characteristics after 100,000 gallons of 220°F. hot-water service. Slot in bronze disc (at top) has worn away to an extent that the meter no longer functions accurately Penton test disc (at left) remains relatively unchanged after same exposure, as compared with production line part (right photo).

Drymaster is typical of the way this versatile new thermoplastic can be precision-molded to provide superior, low-cost replacements for expensive machined metal parts.

Although one of the newest of plastics, Penton chlorinated polyether was exhaustively tested during five years of product evaluation prior to its recent introduction as a commercial material for use in such applications as: valves, pipe, fittings, tank linings, pump and meter parts.

For complete details on Penton, including a folder charting Penton's resistance at elevated temperatures to more than 250 chemicals, call or write Hercules.

**Tradename of Economics Laboratory, Inc., St. Paul, Minn. Information regarding meters and Disc and Half-Ball Assemblies is available from the Industrial Division, Economics Laboratory, Inc., St. Paul 1, Minnesota.*

Design Hi-lites

The idea of forming a complete plastic container having a molded hinge and catch to join the body and the lid is not new. However, prior to the advent of Pro-fax® polypropylene, it was not possible to achieve a tough, rigid unit of this type, with a hinge of virtually unlimited flex life and a tight-fitting, easily operable fastener.

The economic advantages of such an assembly—whether it is designed to serve as an appliance housing, in luggage, or for consumer packaging—are readily apparent. Fittings can be eliminated, together with the costs of finishing and assembly. In many instances, the completed part emerges from the mold, ready for shipment and use.

Whether you expect to use Pro-fax to exploit this special design feature, or because of its many other desirable properties, we'll be glad to help you with your product planning. Our technical service group has had extensive experience in designing, engineering, and processing Pro-fax for products of all types. It can assist you in the development of parts which will take optimum advantage of the properties of this versatile plastic, and, at the same time, minimize processing, finishing, and assembly problems.

A fine example of a handsomely styled new product which "hinges" on Pro-fax is the "Platter Porter", a new phonograph accessory which promises to become a teen-ager's "must". Designed and produced by Columbus Plastic Products, Columbus, Ohio, this portable case for 45rpm records is lightweight, colorful, with a striking leather-grain finish impervious to weathering, staining and hard knocks. With a molded hinge and catch, there's no risk of breakage at these key points, and at the same time this new approach to luggage design greatly simplifies assembly and finishing problems.

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HERCULES

THREE NEW MATERIALS FOR THE PLASTIC INDUSTRY

CP59-20

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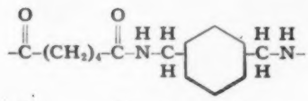
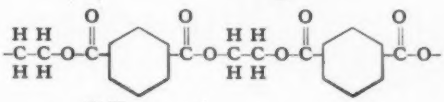
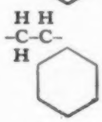
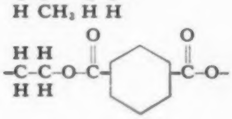
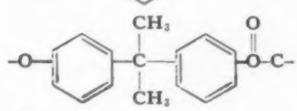
Table III: Total volatiles evolved by polymers on exposure in vacuum to 6 megarads of gamma radiation (Ref. 62, 63)

Material	*Structure*	*Volatiles* micromoles/g. of sample[1]
Polyamide MXD-6		0.2
Polyester[2]		0.2
Polystyrene		0.4
Chlorinated polyether	CH₂Cl H	H -C-C——C-O- H	H CH₂Cl	0.5
Polymonochlorotrifluoroethylene	F F -C-C- Cl F	0.6
Rubber hydrochloride	H Cl H H -C-C—C-C- H CH₃ H H	0.7
Polyester		0.9
Polycarbonate		1.6
Polyamide 66	O O ‖ ‖ H H -C-(CH₂)₄-C-N-(CH₂)₆-N-	3.5
Polyamide 11	O H ‖ H -C-(CH₂)₉-C-N- H	4.8
Polyvinylidene chloride	Cl H -C—C- Cl H	8.2
Polyethylene (branched)	H H -C-C- H H	19.7
Polyformaldehyde	H -C-O- H	85

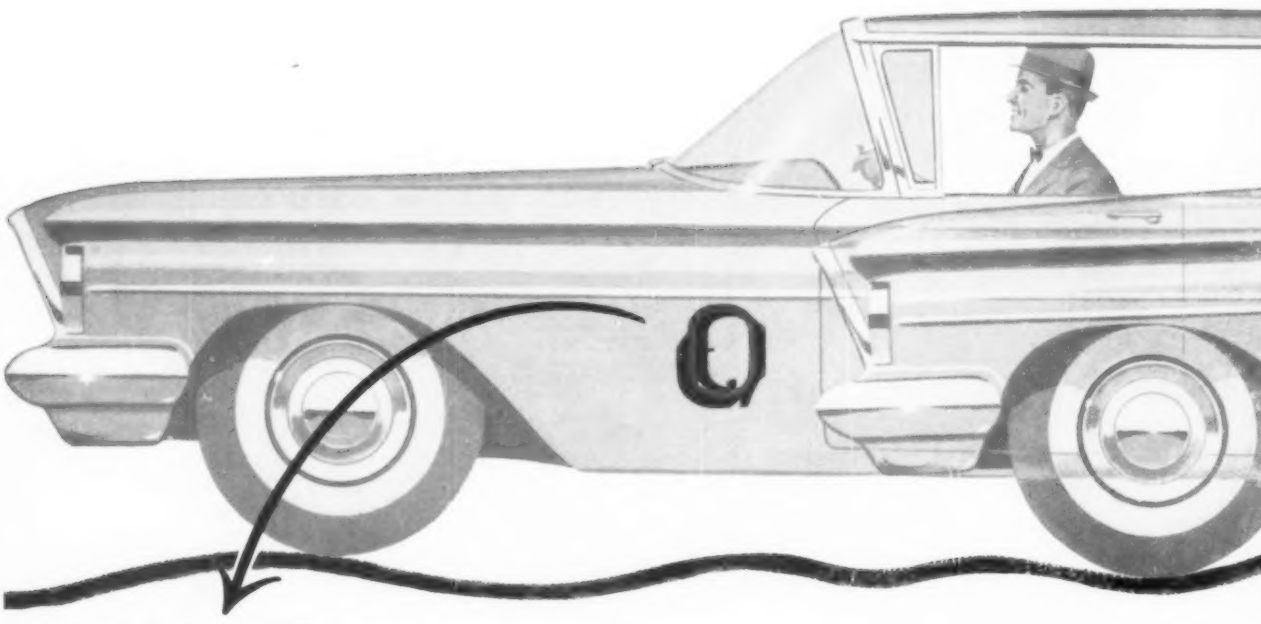
[1]As analyzed by mass spectrometry.
[2]Film had a chlorine-containing coating.

absorbed. The frequency of ultra-violet radiant energy absorbed depends in part on the chemical structure of the material being irradiated. The carbonyl group of an aldehyde or ketone absorbs at 1870 Å. and in the region of 2800 to 3200 Å.; the C-C at 1950 Å and the region of 2300 to 2500 Å.; the hydroxyl at 2300; and the C=C primary bond at 1350 Å. (44).

Considering the ultra-violet wavelengths available at the earth's surface from sunlight, only the carbonyl group in a polymer would appear to be able to act as the seat for ultra-violet absorption. Undegraded and pure poly-(vinyl chloride), for example, should not absorb the wavelengths of sunlight available at the earth's surface and should, theoretically, be photochemically stable. When the polymer contains double bonds, as a result of thermal degradation, or carbonyl groups, as a result of oxidation, a condition exists in which ultra-violet energy can be absorbed and hydrogen chloride can be removed from the polymer backbone. This creates a conjugate system of double bonds and carbonyl groups with a resultant shift of absorption toward longer wavelengths and photochemical reactions can be initiated (45). The energy absorbed need not produce reaction at the absorption site in a (To page 142)

IMPACT STYRENE

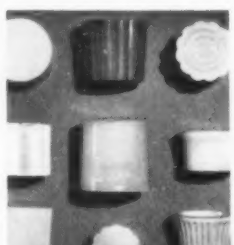
...injection molded air ducts



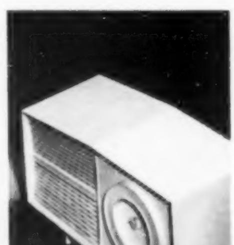
There are two of these impact styrene ducts in each car. Diagram shows their position. Look for them on the new models. They are molded by Wolverine Plastics Inc., Milan, Mich.

Other styrenes in this series

High impact and fast cycle. TMD-6000 is a high impact material for a wide variety of uses—especially where mold filling is critical. It combines set-up speed with plasticity . . . flows easily in large, complex parts, yet sets quickly. (Toy railroad car molded by The Lionel Corporation.)



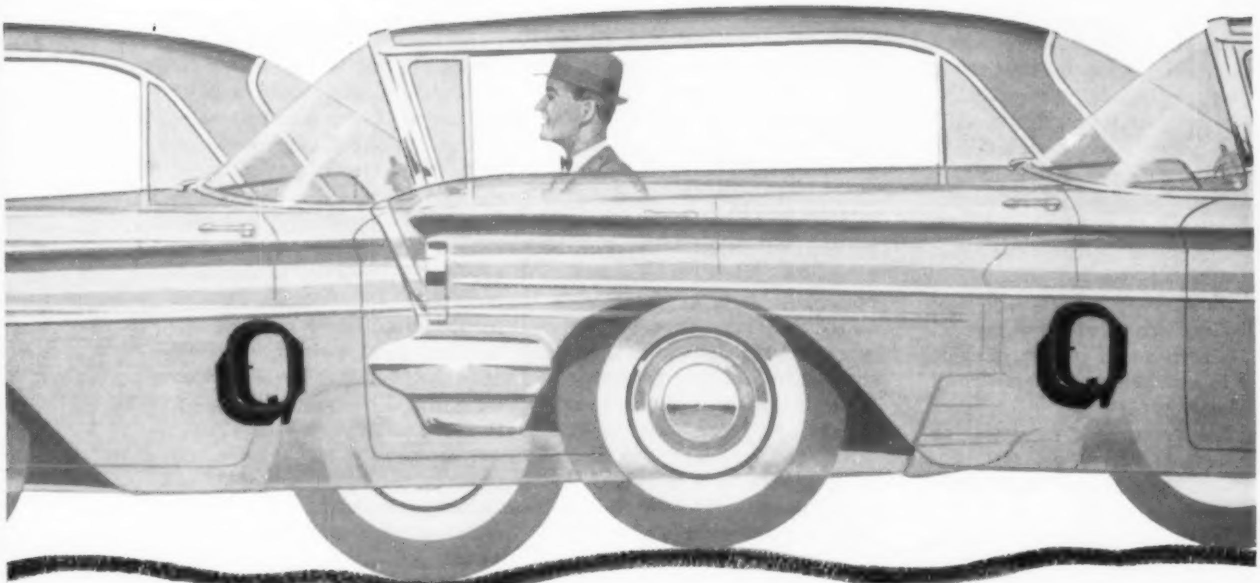
Medium impact, broad molding latitude. In fact, BAKELITE Brand styrene TMD-9001 is formulated for the widest molding latitude in its class. It is especially good for complex shapes that tax machine capacity. Molded in thin sections, it can be stapled with practically no blushing. (Closures molded by Mack Molding Company, Inc.)



Medium impact and heat resistance. TMD-8000 offers excellent gloss and dry colorability. Production experience indicates that it can be broached without crazing and has high scratch resistance. (Radio cabinet molded for Motorola, Inc. by G. Felsenthal & Sons, Inc.)

ON THE GO!

in Detroit's latest cars



This year's automobiles give impact styrene a tough new job. This air duct has to withstand strain, vibration and heat during both installation and use.

BAKELITE Brand impact styrene TMD-5161 was chosen for its outstanding resistance to both heat and impact—and the molding advantages brought lower costs, faster production. Notice this air duct's intricate design—TMD-5161 is free-flowing enough to fill large complex molds. Rigid but tough, it also takes inserts and self-tapping screws.

TMD-5161 is just one of a series of impact styrenes for injection molding offered by Union Carbide Plastics Company. They are available in a range of impact strengths and heat deflection temperatures. Various formulations offer combinations of properties that should closely fit your needs.

To help in making your choice, the latest issue of MOLDING NEWS, "the Test of Impact," gives plastics fabricators detailed information and suggestions on the use of these materials. Write Dept. **LC-02G,** Union Carbide Plastics Company, Division of Union Carbide Corporation, 30 E. 42nd Street, New York 17, New York. In Canada, Union Carbide Canada Limited, Toronto 7.

UNION CARBIDE

polymer since it can be dissipated throughout the long chains and break weak bonds, such as ether linkages, which themselves may not be able to absorb the ultra-violet directly.

Comparatively little work has been done on the degradation of polymers by ultra-violet light under closely controlled conditions. Bateman (46) observed that rubber hydrocarbon degrades on exposure, in vacuo, to wavelengths of less than 4000 Å, at room temperature. The polymer becomes insoluble and evolves gases, mainly hydrogen. Elevation of the temperature above 150° C. results in the evolution of small but significant amounts of isoprene. It is possible that the double bonds in the polymer are responsible for the absorption of the ultra-violet radiant energy but this primary act may not be directly responsible for the eventual liberation of hydrogen or isoprene.

Polystyrene is relatively stable to ultra-violet radiation, even in the presence of oxygen, provided it is a pure polymer and free of monomer (47).

The presence of a strong absorbing group will not necessarily always result in degradation. Acrylic resins have been recognized for some time as being very resistant to the effects of ultra-violet light (48), even though they contain the ultra-violet-absorbing carbonyl structure. However, poly(methyl methacrylate) will degrade rapidly to monomer when irradiated with ultra-violet of 2537 Å. at 130° C. in vacuo (49).

In basic research on mechanisms of degradation, prototype molecules may be used to overcome some of the difficulties of working with complex polymer molecules, and wavelengths shorter than 3000 Å. may be employed to provide sufficient energy to produce primary chain scission. The carbonyl structure, which is readily available in small molecules, offers a strong absorption group for such studies. Acetone, for example, does not absorb wavelengths greater than 3300 A.; and has an absorption maximum in the 2700 to 2800 Å. region (50). Although studies at shorter wavelengths have previously been criticized as not applicable to exposure conditions, the exploration of space where ultra-violet wavelengths as short as 10 Å. will be encountered has shown the need for accelerating studies at shorter wavelengths.

An excellent example of the use of prototypes to elucidate photodegradation mechanisms in polymers is the work of Kenyon (51) using sec-butyl chloride as a prototype for poly(vinyl chloride). When this study was started, it was known that alkyl chlorides are light stable and have no ultra-violet absorption above 2200 to 2300 Å. unless impurities are present. In the region in which they do absorb, sufficient energy is present to produce C-Cl scission. Kenyon found that sec-butyl chloride absorbed in the region 2700 to 3000 Å. suggesting the presence of carbonyl; irradiation at wavelengths greater than 2700 Å. resulted in the evolution of hydrogen chloride. Purifying the sec-butyl chloride with alkaline permanganate shifted the ultra-violet absorption to the 2300 Å. region; irradiation of this purified material at wavelengths greater than 2700 Å. produced no hydrogen chloride. When acetone was added as a photosensitizer, hydrogen chloride was liberated in an amount proportional to the concentration of acetone. It was further established by research that methyl radicals resulting from the photolysis of the acetone were the decomposition initiator for the sec-butyl chloride.

Some types of antioxidants may promote polymer degradation by strongly absorbing ultra-violet radiation and transferring the en-

Table IV: Oxidation effects at wet-dry interfaces on fibrous materials (Ref. 79)[1]

Experiment	*Fibrous material*	*Liquid*	*Atmosphere*	*Time when fluorescence was observed*
1	Cotton, light excluded	Benzene	Oxygen	Within 16 hr.
2	"	Xylene	"	"
3	"	Chloroform	"	Within 12 hr.
4	Cotton	n-Pentane	"	Within 16 hr.
5	Cotton, no interface, entire strip wet	"	"	No fluorescence within 3 days
6	Cotton, degassed for 8 days	"	Nitrogen	Within 24 hr.
7	Cellulose acetate	Water	Oxygen	Within 40 hr.
8	Nylon	"	"	"
9	"	n-Pentane	"	Within 24 hr.
10	Nylon, no interface, entire strip wet	"	"	No fluorescence within 3 days
11	Nylon	"	Nitrogen	"
12	"	n-Pentane, shaken 12 hr. with HO_2 and then degassed	"	"
13	Quartz, light excluded	n-Pentane	Oxygen	Within 24 hr.
14	Quartz	"	Nitrogen	No fluorescence within 3 days

[1]Unless otherwise indicated, a strip of the fibrous materials was suspended in the liquid in such a way that a wet-dry interface was present on the fibrous material and evaporation took place at room temperature. The fluorescence was observed at the interface. Experiments were carried out in the diffuse light of the laboratory, except as indicated.

ergy to the groups in the polymer involved in the photodegradation reaction. For example, in polyethylene some phenolic and amino antioxidants that suppress thermal oxidation during processing (140 to 200° C.) accelerate the photo-oxidation. The oxidative chain reaction is initiated by the photolysis of carbonyl groups (always present in processed polyethylene) to form free radicals, and one of the main products is more carbonyl groups. It is necessary to absorb the damaging radiation with a light absorber that will dispose of the energy harmlessly. Burgess (52) found that light stabilizers that fluoresce in the visible or ultra-violet are in general sensitizers for polyethylene oxidation, so clearly loss of electronic energy by fluorescence is too slow a process; rapid conversion of electronic energy to thermal energy is needed. He postulates that stabilizers for polyethylene must have a lowest excited level that is lower than 70 kcal. electronic energy, which is the limit that polyethylene can tolerate without chemical breakdown. Thus, this explains the fact that no really efficient colorless stabilizers for polyethylene have been found, since transitions to this lowest excited level lie, of course, in the visible.

Table V: Resistance of plastics to outdoor weathering (Ref. 102)

1. *Good long-term resistance*
   Polytetrafluoroethylene
   Glass base laminates
   Polymethyl methacrylate (optical and electrical properties only)
   Cast allyl resin (optical and electrical properties only)

2. *Good short-term resistance (in addition to the above-listed materials)*
   Cellulose propionates
   Phenolic laminates (not glass base)
   Melamine-formaldehyde
   Urea-formaldehyde
   Cast allyl resin (mechanical as well as optical and electrical properties)

3. *Poor resistance*
   Polyamides
   Polystyrene
   Ethyl cellulose
   Cellulose nitrate
   Polyvinyl alcohol
   Silicone rubbers
   Cast phenolic

4. *Resistance dependent upon additives, formulations, etc.*
   Cellulose acetates
   Cellulose acetate-butyrates
   Molded phenolics
   Polyethylene
   Polyvinyl chloride
   Polyvinyl chloride-acetates

Nuclear radiant energy

When polymers are exposed to high energy nuclear radiation, such as gamma photons, chemical bonds are broken and the material degrades, yielding gaseous decomposition products and fragments of various sizes. A schematic presentation of the reaction of nuclear radiation with a hydrocarbon polymer is given in Fig. 2, p. 145. As a result of irradiation, ionization occurs and free radicals are produced which initiate chemical reactions involving both scission and cross-linking, thereby altering the properties of the polymer. Thus, as in the case of thermal and ultra-violet radiant energy, the ultimate effects of exposure to high energy radiation are scission and cross-linking. These may occur simultaneously with one effect predominating over the other, depending on the structure of the material and the environmental conditions, such as presence of oxygen. Cross-linking occurs in polyacrylic esters, polystyrene, polyesters, nylon, polyethylene, natural rubber, styrene-butadiene, butadiene-acrylonitrile, neoprene, and poly-dimethylsiloxanes. Scission predominates in poly(methyl methacrylate), poly(vinyl chloride), poly(vinylidine chloride), Teflon, Kel-F, cellulose, and polyisobutylene (53-59).

A correlation that has been observed (60) between chemical structure and stability to nuclear radiation is shown in Fig. 3, p. 148. This order of decreasing resistance was established by measurement of changes in physical properties, such as tensile strength, hardness, elongation, and other properties as a function of total dosage of nuclear radiation.

An intensive investigation (61) involving gamma irradiation of plastics was made with the objective of correlating chemical changes with physical property changes and to acquire knowledge of the chemical reactions producing the changes in physical properties. Infra-red absorption spectroscopy was used to determine changes occurring in the molecular structure of the polymers and mass spectrographic analyses were made of the gaseous products given off during irradiation of the materials in vacuo. Polymers containing aromatic groups, which included a polycarbonate, a polyester, and styrene materials, were observed to be most stable to radiation as shown by both chemical and physical properties. Low-density polyethylenes and plasticized polyvinyl chlorides followed in order of stability. High-density polyethylene was reported to be considerably less stable than low-density polyethylene; this was attributed to greater oxidation occurring in the high density material. Polytetrafluoroethylene was found to have the least resistance to gamma irradiation of the materials studied. Higher exposures to irradiation are needed to completely classify all the materials studied. Good correlation between chemical and physical property changes is not always feasible on exposures of only 1×10^8 roentgens because incipent and small chemical changes are not detectable by infra-red or mass spectrometric analyses, although these changes can lead to small or large changes in physical properties that are very obvious.

Table III, p. 139, shows an apparent order of stability of polymers based on total volatiles evolved on exposure to gamma radiation (62, 63). The materials can be classified in three groups:

1) those evolving less than 1 micromole per gram; 2) those of intermediate stability evolving 1 to 5 micromoles per gram; and 3) those evolving more than 5 micromoles per gram.

These studies show some of the correlations between the chemical structure of polymers and their resistance to some extent to nuclear radiation. The order of stability for specific chemical groups is dependent on the criteria used to judge the degree of stability. For example, it has been shown by mechanical test criteria that materials containing the benzene ring in the polymer chain have poorer radiation stability than materials such as styrene and aniline-formaldehyde in which the benzene ring is attached as a side group (64). The results given in Table III based on gas evolution as the criterion of stability show that a polyamide and a polyester containing phenyl groups in the chain are as stable as, or even slightly more stable than, polystyrene.

The saturated ring structure of the cellulosics is, on the other hand, unstable and gas is evolved freely with ultimate failure occurring by chain cleavage (65, 66).

Chain scission predominates in vinyl polymers containing the following structure

$$-CH_2\overset{R'}{\underset{R}{C}}-$$

in which the carbon bearing the side chain R has no hydrogen atom but has an α-substituted R′ group, which can be a hydrocarbon or a halogen. The α-substituent causes a steric strain, particularly in the case of a methyl group, which is responsible for weakening the carbon-carbon bonds in the main chain (59, 67). Cross-linking in polymers results when radical sites are produced on adjacent chains of polymer molecules (68). Cross-linking and unsaturation are produced in polyethylene which turns dark in color, gives off gas, and becomes brittle (64).

Oxygen adds another factor to an already complicated picture in nuclear irradiation studies. It may accelerate the degradation of some polymers and in others have little or no observed effect (69). Scission apparently predominates over cross-linking when polyethylene is irradiated in the presence of oxygen (70). The extent of main chain scission of polyisobutylene does not seem to be affected whether oxygen is present or not, although the decomposition products will differ (71). Poly(methyl methacrylate) may be unaffected (72) with respect to scission on irradiation in oxygen, or the scission reaction may actually be accelerated (73). It is not yet clear whether the role of oxygen is primarily to slow down cross-linking or whether it is to accelerate scission (74).

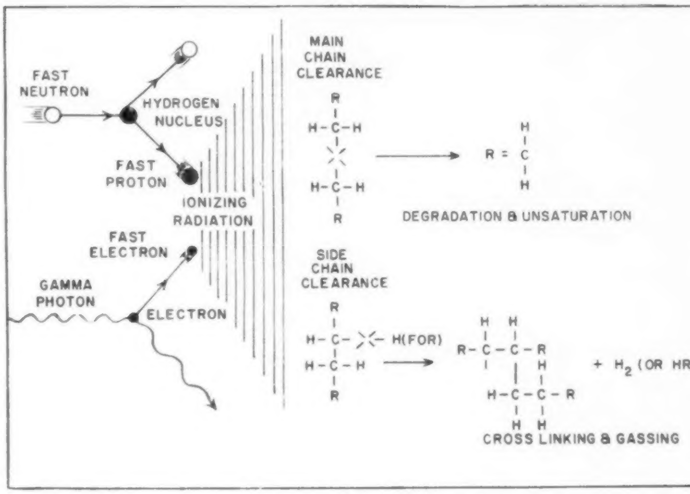


FIG. 2: Reaction of nuclear radiation with a hydrocarbon polymer (taken from Reference 64).

Oxygen

Reactions involving most polymers and oxygen under ordinary temperature conditions are usually extremely slow, requiring months or years to even be detectable. However, the properties of unsaturated polymers change much more rapidly. Purified polyisoprene, i.e., free of antioxidant, in the condition of a low-density foam may spontaneously ignite in air at temperatures near normal room temperatures. Such rapid oxidation is the exception rather than the rule. Natural rubber, styrene-butadiene rubber, and simiar unsaturated polymers are, of course, well protected from reaction with oxygen at room temperatures by the addition of small amounts of antioxidants.

The more serious problem is the synergistic effect that elevated temperatures, ultra-violet radiation, nuclear radiation, etc., have on the oxidation of all polymers. For example, there is no observable change in the ultra-violet absorption spectrum of purified polystyrene stored in the dark in air at 25° C. over a period of several years. However, strong absorption bands appear in the spectrum of a specimen of the same polystyrene after 290 hr. exposure to an S-1 sunlamp in air (75). Polyethylene is another polymer that exhibits poor stability to oxidation in the presence of ultra-violet radiation. One solution of this problem has been to "shut off the light" by means of opaque substances, i.e., opaque to the most damaging radiation which is in the region of 2500 to 3500 Å wavelength and corresponds roughly to the absorption frequency that is apparent for the carbonyl groups (1).

The effect of oxygen may not always be undesirable as is suggested by a patent (76) for the improvement of flexibility, toughness, and resistance to embrittlement on aging of polyamides. The procedure involves heating linear polyamides for a short period at temperatures above the melting point of the polymer but below decomposition temperature in air or oxygen. Reac- **(To page 148)**

Naugatuck KRALASTIC

RESIN-RUBBER COMPOUNDS

KRALASTIC molding and extruding compounds are unique combinations of thermoplastic resins and nitrile rubber. The result is an almost indestructible end product of exceptional strength, toughness and impact resistance.

Extruded as plastic pipe, Kralastic has proved phenomenally successful and durable in transporting salt water and sour crude in the oil fields; carrying natural gas, drinking water, corrosive chemicals, irrigating water; and as money-saving, quickly-installed electric conduit.

With the recently introduced Kralastic HTHT (high temperature, high tensile) and the dramatic new Kralastic MM, a compound so tough, so resistant to heat, staining and abrasion it rivals nylon, the Kralastics offer molders and users everywhere a combination of properties that is truly exceptional.

Consult us for experienced application advice, for information on independent test results, for whatever assistance you may require.

Helmets of practically eve[ry] description are lightweig[ht] colorful, easily molded, tou[gh] and impact resistant as o[nly] Kralastic can make them.

PROPERTY	UNITS	ASTM TEST METHOD	KRALASTIC B	KRALASTIC F
PHYSICAL				
Specific Gravity (Natural Color)*			1.06	1.04
Impact Strength (¼'' Bar Sample)				
Izod Notched, 73°F.	ft. lbs./in. notch	D256-56	5-9	3-6
Izod Notched, 32°F.	"	"	1.8	1.5
Izod Notched, −40°F.	"	"	0.6	0.4
Charpy Unnotched, 73°F.	ft. lb./in.	"	35-58	28-42
Charpy Unnotched, 32°F.	"	"	35-50	40-45
Charpy Unnotched, 0°F.	"	"	35-50	21-26
Charpy Unnotched, −40°F.	"	"	8	6-8
Compressive Strength	psi	D695-54	6,400	5,800
Compressive Modulus	psi	D695-54	290,000	280,000
Flexural Strength	psi	D790-49T	8,000	7,500
Flexural Modulus	psi	D790-49T	260,000	250,000
Tensile Strength	psi	D638-52T	5,500	5,000
Hardness, Rockwell	R Scale	D785-51	96	92
Thermal Coefficient of Expansion	in./in./°F.	D696-44	0.000056	0.000056
Thermal Conductivity	B.T.U./hr./ft.^{2} per°F./in.	C177-45	1.7	2.0
	Cal/sec./cm^2/°C./cm		0.00060	0.00069
Specific Heat	B.T.U./lb./°F.		.37	.36
Deflection Temperature, 264 psi	°F.	D648-45T	187	185
Water Absorption, 24 hrs.	% Gained	D570-54T	0.3	0.2
Compression Ratio (Bulk Factor)		D392-38	1.8-2.0	1.8-2.0
Compression Molding				
Temperature	°F.		325-400	325-400
Pressure	psi		1000 +	1000 +
Injection Molding				
Temperature	°F.		375-600	350-600
Pressure	psi		6,000-30,000	6,000-30,000
Mold Shrinkage (Average)	in./in.		.004-.005	.004-.005
Extruding Temperature	°F.		350-450	350-450
Calendering Temperature	°F.		350-400	325-400
ELECTRICAL				
Dielectric Strength Short Time ⅛''	Volts/Mil	D149-55T	312	351
Volume Resistivity (35% Relative Humidity at 73°F.)	Ohm/Cm.	D257-54T	1.8×10^{13}	1.1×10^{13}
Dielectric Constant		D150-54T		
60 CPS		"	4.76	4.15
1000 CPS		"	4.45	4.20
10^6 CPS		"	3.78	3.61
3000×10^6 CPS		"	2.76	2.70
Dissipation Factor		D150-54T		
60 CPS		"	0.021	0.015
1000 CPS		"	0.002	0.002
10^6 CPS		"	0.026	0.026
3000×10^6 CPS		"	0.006	0.006
Loss Factor		D150-54T		
60 CPS		"	0.101	0.062
1000 CPS		"	0.010	0.007
10^6 CPS		"	0.099	0.094
3000×10^6 CPS		"	0.016	0.015

*Specific gravity of colors will vary with the pigmentation used.
†Heat distortion of 225°F. is obtained by annealing for 2 hours at 220°F.

These KRALASTIC materials are arranged in order of decreasing Impact Strength except J, L and HTHT, which have special outstanding properties.

Pipe, valves, and fittings of Kralastic are extremely tough, noncorroding, easy to install, approved for drinking water. A proven superior product in over 9,000 miles of installation.

Large formed parts have high dimensional stability, excellent resistance to most chemicals, and high mechanical strength even in thin sections.

Distinctive Properties:

- High impact resistance
- Extreme toughness combined with hardness
- Lightweight: ½ weight of aluminum; 1/7 weight of iron
- Noncorrosive, nonelectrolytic
- Readily sawed, drilled, and threaded
- Quickly solvent welded
- Dimensionally stable over a wide temperature range
- Opaque built-in colors

Major Uses:

- Pipe and pipe fittings
- Light wheels, gears and pulleys
- Durable hair combs
- Machine housings and parts
- Textile warp tubes and bobbins
- Radio and camera cases
- Football and safety helmets
- Tote boxes
- Hose nozzles and fertilizer injectors

KRALASTIC 2907	KRALASTIC MM (Formerly Kralastic 2590)	KRALASTIC D	KRALASTIC J	KRALASTIC L	KRALASTIC HTHT
1.06	1.07	1.05	1.02	1.02	1.08
1.5-3.5	0.7-1.5	0.4-1.3	6-9	5-7	3-4
1.8	0.7	0.4	5-6	3-5	2.0-2.5
0.3-0.8	0.4	0.4	1-3	1.5-2.5	0.3-0.5
30-50	20-30	23-33	25-35	30-45	30-50
—	—	23-33	25-30	—	20-30
—	—	10	—	30-40	15-25
25	20	8	35-40	30-40	10-15
10,500	11,000	9,000	4,000	5,600	10,000
350,000	370,000	430,000	190,000	200,00	290,000
11,500	13,500	11,500	4,000	6,500	12,000
400,000	450,000	390,000	170,000	275,000	370,000
7,800	8,800	6,500	3,000	4,000	8,000
115	118	108	62	88	116
0.000042	0.000032	0.000047	0.000073	0.000048	0.000038
1.6	1.8	1.7	2.1	2.3	2.5
0.00057	0.00062	0.00058	0.00072	0.00079	0.00086
.37	.38	.37	.38	.40	.37
198	200	193	172	175	225+
0.3	0.3	0.2	0.2	0.2	0.2
1.8-2.0	1.8-2.0	1.8-2.0	1.8-2.0	1.8-2.0	1.8-2.0
325-400	325-400	325-400	325-400	325-400	350-500
1000+	1000+	1000+	1000+	1000+	1000+
375-600	350-600	350-600	350-600	350-600	400-600
6,000-30,000	6,000-30,000	6,000-30,000	6,000-30,000	6,000-30,000	6,000-30,000
.004-.005	.004-.005	.004-.005	.004-.005	.003-.004	.004-.008
350-400	350-450	350-450	350-450	350-450	400-500
—	—	325-400	300-375	300-375	—
385	386	350	340	384	363
$>2.7 \times 10^{15}$	$>2.7 \times 10^{16}$	$>10 \times 10^{13}$	0.54×10^{13}	1.3×10^{13}	$>10 \times 10^{13}$
3.17	3.10	3.41	4.00	3.70	3.54
3.12	3.08	3.54	4.47	3.52	3.43
3.08	3.02	3.20	4.05	3.48	3.24
—	—	2.66	2.80	—	—
0.005	0.004	0.009	0.011	0.073	0.034
0.005	0.005	0.002	0.002	0.008	0.012
0.009	0.010	0.017	0.018	0.020	0.021
—	—	0.003	0.008	—	—
0.016	0.012	0.030	0.043	0.270	0.120
0.016	0.015	0.005	0.010	0.028	0.040
0.028	0.030	0.053	0.072	0.069	0.067
—	—	0.009	0.021	—	—

tion is a surface one and leaves the interior of thick samples unaffected. Limited oxidative cross-linking of linear chains would produce the desirable properties mentioned in the patent.

An unusual but important type of oxidation occurs with cellulose at wet-dry interfaces in air at ambient temperatures (77, 78). A brown line soon develops at the boundary between the wet and dry portions of a strip of cotton cloth immersed partially in water. The brown color is caused by water-soluble substances which fluoresce in ultra-violet light. When the brown material is washed away, the cloth is found to be oxidized and weakened at the site of the wet-dry boundary. More recently, an investigation (79) of a variety of systems of fibrous materials and liquids has shown that enhanced oxidation at wet-dry boundaries is a fairly general phenomenon. A summary is shown in Table IV, p. 142.

An example of the extreme complexities of oxidative degradation in the presence of elevated temperatures and/or ultra-violet radiation is the rapid dehydrochlorination of poly(vinyl chloride) and poly(vinylidene chloride) under these conditions. The overall evidence at present indicates a free-radical chain mechanism for the dehydrochlorination (35, 80). In practice under normal atmospheric conditions the mechanism is complicated by a concomitant oxidation process, the result of which may be an increase in the rate of dehydrochlorination (81, 82). The double bonds formed by removal of hydrogen chloride activate adjacent chlorine atoms, promoting selective dehydrochlorination leading to conjugated unsaturation and color development. However, these double bonds are subject to concomitant oxidation, resulting in intermediates that also catalyze the dehydrochlorination of the polymer.

The presence of free radicals in polymers previously exposed to ionizing radiation has been shown by paramagnetic resonance (83) and chemical studies (84). In one paramagnetic resonance study (85) of polytetrafluoroethylene irradiated with X-rays, changes in resonance on exposure to oxygen indicated that the radical

$$\begin{matrix} F \\ C\cdot \\ F \end{matrix}$$

produced initially was converted to the radical

$$\begin{matrix} F \\ COO\cdot \\ F \end{matrix}$$

Further effects of oxygen and ionizing radiation may be shown by the observation that heating a previously irradiated rod of poly(methyl methacrylate) above its glass transition temperature will cause bubbling or foaming of the polymer (86). This effect is considered to arise from the expansion of the gases produced in irradiation, aided by the lower molecular weight and hence lower viscosity, which also results from the irradiation. It is likely also that monomer, produced as a result of depolymerization induced by free radicals formed both by the irradiation and by the decomposition of peroxidic groups produced during irradiation, contributed significantly to this effect (73).

Water

The vulnerability of a given polymer to specific chemicals will depend on the chemical structure of both the polymer and the chemical. Only water will be dealt with in some detail in this paper. The effects of other chemicals on polymers have been reported or reviewed in considerable detail elsewhere (87-93).

The most important of all chemical degradation agents is water. It is involved in corrosion of metals, in oxida- **(To page 216)**

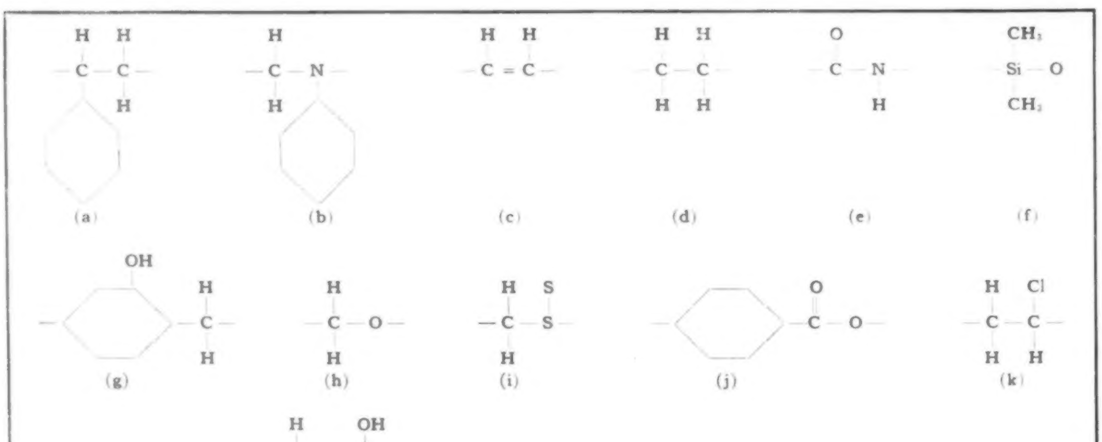


FIG. 3: Chemical structures ranked in order of decreasing radiation stability (from Ref. 57).

Film for bread wrappers extruded from Tenite Polyethylene by Pollock Paper Company; general offices, Dallas, Texas. Plants and sales offices located coast to coast.

Bread now goes to market the modern way...wrapped in film of **TENITE POLYETHYLENE**

Pollock Paper Company, *division of St. Regis Paper Co., using medium-density Tenite Polyethylene, supplies bread wrappers offering many advantages to both bakers and housewives*

When bread is wrapped in film of Tenite Polyethylene, housewives are getting maximum freshness protection...grocers, a package with super sales appeal...and bakers, two-way economy: reduced wrapping costs, with fewer stale returns.

Film extruded from medium-density Tenite Polyethylene offers an ideal combination of properties: resistance to moisture transmission prolongs freshness; sparkling finish and outstanding clarity add sales appeal; softness of feel emphasizes the bread's freshness. This film also possesses just the right stiffness and slip for efficient use on high-speed packaging machines. Its wide heat tolerance means efficient operations on wrapping machines, and minimizes waste. And, in use, film of Tenite Polyethylene retains its strength even at low temperatures. From wrapping room to kitchen it offers maximum resistance to impact and tearing.

For all these reasons, Pollock Paper Company, the nation's leading supplier of bread wrappers, has selected Tenite Polyethylene as its standard of quality. Extruded on special equipment to assure utmost clarity and sparkle, Pollock's "POLY-SEAL" film is used by bakers from coast to coast.

The successful development of a medium-density Tenite Polyethylene with all the properties needed by the baking industry, once more demonstrates the basic versatility of Tenite Polyethylene and the capability of Eastman research, production, and technical service. Whatever your interest in polyethylene, look to Eastman for the type you need. For more information, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

TENITE®
POLYETHYLENE
an Eastman plastic

REPORT FROM DUESSELDORF

Important advances in machinery, materials, and applications noted at the Kunststoffe 1959 Fair. Here are the significant highlights

MACHINERY

Exhibits at the Kunststoffe Exhibition, which was held Oct. 17-25 in Düsseldorf, West Germany indicated that almost every European country has contributed something significant to progress in plastics machinery, and that many companies have shared in the important new developments in this section of the industry.

Some of the more outstanding innovations will be discussed in greater detail in forthcoming issues; the following is a report on the highlights of the Exhibition.

Injection molding machines

There is an almost universal change to screw plasticating of one type or another on injection molding machines. Also, many vertical injection machines were exhibited; European processors use this type of equipment extensively for articles with metal inserts.

The most dominating injection machine was a gigantic unit shown by Triulzi, Milan, Italy. The machine, Model 12/350/1800, has a 425-oz. capacity and is capable of plasticating 772 lb. per hour. It uses a piggyback-type screw preplasticator to feed the plunger cylinder and has a clamping capacity of 1800 tons. It can take molds up to 39 in. high and has inside platen dimension of 73 by 51 inches. Triulzi makes a still larger model (not shown at Düsseldorf). This machine has a 704-oz. shot and an 882-lb. plasticating capacity. The company also showed its fast Rocket 70, an injection machine capable of producing 1800 shots per hour (photo below). It is equipped with a screw-type preplasticator; has an 8-oz. shot capacity; toggle-type clamping; and can be operated manually or fully automatically. Use of an electric eye protects the machine from closing on pieces which may stick in the mold. Molds 2.5 to 6.9 in. thick can be handled.

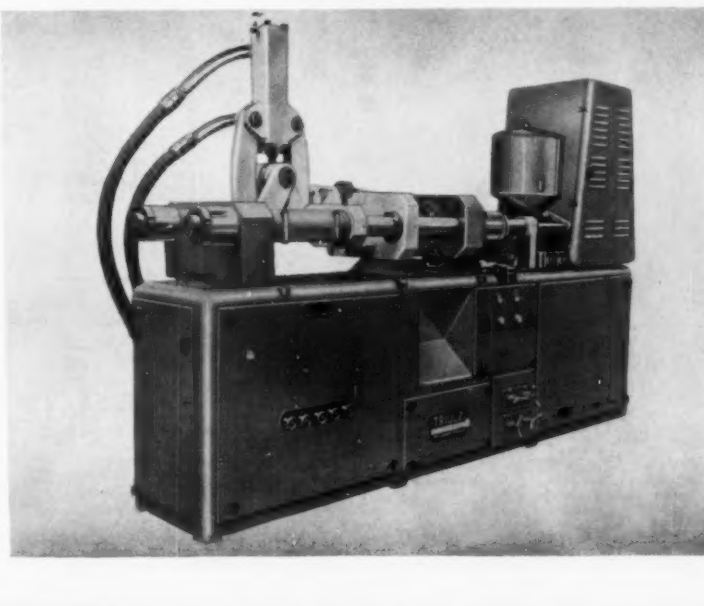
High-speed automatic rotary injection machines, using indexing multiple molds, were featured by A. Nothelfer, Ravensburg, Germany (see diagram, p. 155). In place of the conventional injection ram, these machines have a combination screw-piston which preplasticates the material and injects it from a single cylinder. To inject, the screw rotation is stopped and the screw advanced by a hydraulic cylinder to act as an injection ram. Both a 0.5-oz. (Model SP 15) and a 1.8-oz. (Model SP 50) machine are available. Production rate on the former is 34 shots/min. and on the latter 20 shots/minute. Plasticating capacities are reported to be 30 and 45 lb./hr., respectively.

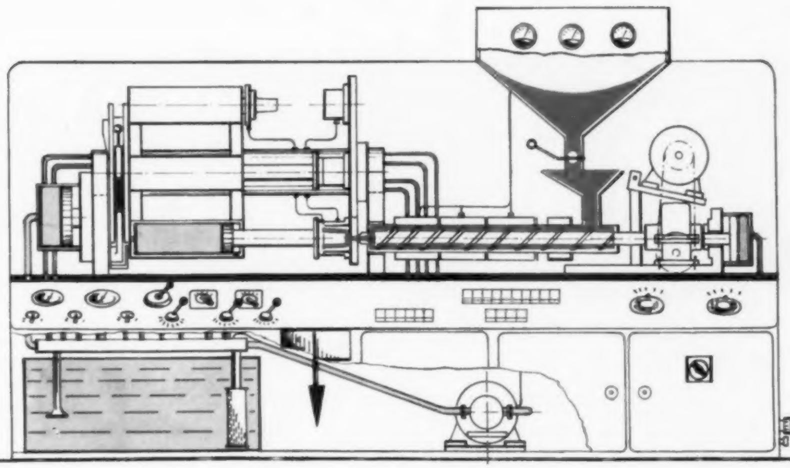
Duplex, Paris, France, exhibited its S60/85, which has an interesting clamp adjustment. All four adjusting nuts on the tie rods are turned simultaneously by turning a single shaft geared to the adjusting nuts. Eliminating the need for individual adjustment of each nut, clamping adjustments are simpler and faster.

Of special interest was the S65/100 displayed by Stübbe, Vlotho, Ger-

The magnitude of the Kunststoffe Exhibition makes it impossible to present here more than a concise outline of the significant developments revealed there. Readers interested in more specific details on any item described in the report are invited to write to the editor for additional information.

TRIULZI'S Rocket 70 injection machine can produce up to 1800 shots per hour. Electric eye prevents mold from closing on stuck pieces.





CUT-AWAY DIAGRAM of Nothelfer's Nora rotary injection machine, showing screw-piston type of preplasticating unit. The screw is hydraulically advanced for injection, as with conventional ram.

many. Many of the larger polycarbonate products at the Fair were molded on this model. The machine, like many of the others shown, utilizes a screw-piston which acts as both preplasticator and injection ram. It has a plasticating capacity of 25 lb./hr.; a maximum shot of 2.4 oz.; and variable screw speeds from 15 to 130 r.p.m.

R. H. Windsor Ltd., London, England, had an impressive display of its wide range of injection molding machines. Particularly outstanding was its AP 200, a new machine featuring the company's two-stage twin-screw Autoplas plasticating equipment. It has a shot capacity of 124 oz. of polystyrene, and is capable of preplasticating 350 lb. of this material per hour. The AP 200 has an 800-ton clamping unit. Plunger speed is rated at 325 in./min. on a 17-in. stroke.

Another new development by Windsor is the fully automatic AP 16, (photo at right), using a combined single-screw-piston preplasticator. Shot capacity is 14 oz. and the hydraulically actuated mechanical clamp force is 175 tons. Plasticating capacity is 100 lb./hour.

The exhibit of Netstal A. G., Netstal, Switzerland, featured its Rotomat 1400/550, which extrudes material into a separate injection chamber. This machine, with a shot capacity from 10 to 50 oz., will plasticate up to 154 lb./hour. Another Netstal exhibit was a plunger machine, the SM 230/1000, with a shot capacity up to 6⅓ oz., which can plasticate approximately 44 lb./hr. and is capable of operating at 600 cycles per hour.

The company also showed its vertical automatic injection molding machine, the SMV-110/1000 (photo, p. 158), designed similar to its SM 60/40, a horizontal unit. This machine is capable of 300 shots per hour; shot size is about 3 ounces.

Negri Bossi & Co., Milan, Italy, displayed several models of its well-known line of injection molding machines, of which the R-3-FA met with particular interest. This fully automatic machine has a maximum injection capacity of 1⅙ oz.; an hourly plasticating capacity of 12 lb; and is capable of 12 shots per minute. An acoustic and visual alarm warns the operator if the part should fail to eject properly.

The company is perfecting some important new developments on their machines, and expects to be ready to reveal these innovations at the Milan, Italy, Fair in April 1960.

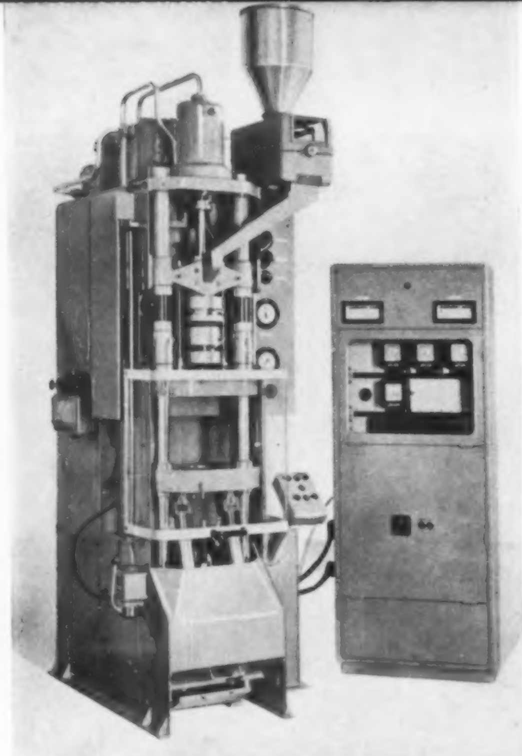
A very broad range of automatic machines with combined single-screw-piston plasticating cylinders was displayed jointly by Ankerwerk, Gebr. Goller, Nuremberg, and Krauss-Maffei A. G., Munich. These two German companies have a coordinated production program, whereby Krauss has a line of machines which supplement the Ankerwerk line. Ankerwerk machines range from 0.6 through 44 oz.; Krauss-Maffei from 3 through 170 ounces.

Both companies introduced new models. Ankerwerk has added its V 10-30, which has a shot capacity ranging from 0.6 to 1.85 oz., depending upon the material. The maximum dry cycle is 1600 shots per hour. Screw speed is variable up to 120 r.p.m. This machine can also be supplied in an extra fast cycling model for applications requiring extremely thin parts.

A new addition to the Krauss-Maffei line was the V 74-550, which also uses the combined screw-piston plasticating scheme. It is capable of plasticating up to 330 lb./hr. and has a shot capacity up to 100 ounces. Both machines are said to be especially suitable for rigid PVC.

Battenfeld, Meinerzhagen, Germany, also showed (To page 158)

INJECTION UNIT of Windsor AP 16. Machine uses a combined single screw-piston preplasticator, can plasticate 100 lb. per hour.



VERTICAL injection machine, Model SMV/110/1000, made by Netstal, has 4-oz. capacity, is especially designed for production of parts with metal inserts.

typical of the company's comprehensive manufacturing program, which includes units with shot weights from 1¼-oz. to 352-oz. (22 lb.).

The Battenfeld injection machines are available in either horizontal or vertical designs. In addition, the company will install its single-screw plasticator on any of its machines. The screw plasticating unit consists of a special extruder assembled on a movable base. Drive is by an enclosed gear drive and electric motor. Change gears allow modification of the speed of the extrusion screw. The unit is arranged behind the machine and fixed to the cylinder into which the plasticated material is extruded.

Two of the larger injection molding machines with screw plasticating BSM 3000 and BSM 5000. The former has a shot weight up to 176 oz., and a plasticating capacity up to 154 lb./hr. The BSM 5000 has an injection capacity up to 222 oz., and a plasticating capacity of 176 lb./hr.

For mass production work, Battenfeld exhibited its fully automatic BSM-40 S 2½-oz. injection molding machine. Speed is 10 shots per minute, and plasticating capacity is 16 lb./hr. Power consumption is low —about 3 kw. per hour.

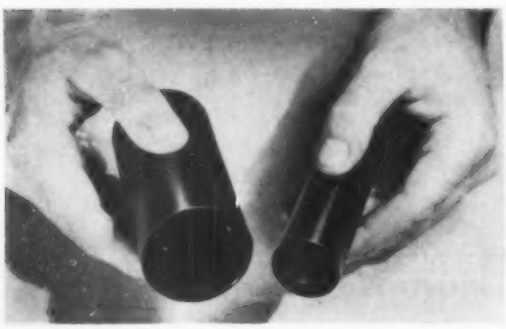
An extrusion-injection machine shown by Paul Troester, Hanover, Germany, features a "lazy Susan" type arrangement: a revolving table with 24 mold station indexes in front of an extruder. As each mold reaches the injection point, it is clamped and filled, and the table several injection molding machines indexed to bring the next mold in line with the extruder nozzle. Molding cycle for each mold can be adjusted from 1.5 to 30 sec. so that different molds can be run, ranging in shot weight from 3.5 to 105 ounces. The choice of extruder depends on the plasticating capacity required by the particular molding job; the company's EP-90 extruder plasticates 285 lb./hr.; its Model EP-120 is capable of handling 550 lb./hour. Operation can be fully automatic or manual.

Extruders

Reifenhäuser, Troisdorf, Germany, and Farbwerke Hoechst, Frankfurt, Germany, have worked together to develop a unique method of biaxially orienting low-pressure polyethylene pipe (photo below). The exciting aspect of this development is that the orientation strengthens the pipe wall, permitting thinner walls for a given pressure and resulting in material saving. In general, half the wall thickness of conventional PE pipe is required in this new process to provide the same burst strength. Briefly, the process consists of drawing unoriented pipe through a metal tube of slightly larger diameter that is immersed in a heating bath. The purpose of the bath is to heat the PE to just below its crystalline melting point. As the pipe emerges from the heating bath, it passes through a larger-diameter forming and cooling section, where it is blown to its final size. Simultaneously, a linear speed differential between feed and take-off is maintained. This concurrent pulling and expansion produces the biaxial orientation.

Werner & Pfleiderer, Stuttgart, Germany, created a stir with its ZSK 120/1500 vented twin screw extruder for material compounding. This extruder features a unique screw construction. The screw is built up on a keyed shaft by using sections of screw flights or kneading disks which are interchangeable along the length of the shaft. By varying the relative positions of the kneading disks and screw flights the overall screw design may be readily changed to suit various processing requirements. Maximum screw length is 59 in. and screw diameter is 4.7 inches. Output ranges up to 2205 lb./hr. and by varying the screw design and venting arrangements, the extruder can be used for preplastication, coloring, compounding, degassing, feeding calenders, etc. The machine (photo, p. 164) will handle rigid and plasticized PVC, as well as dry blends and most other thermoplastics.

Oerlikon Plastics, Stans, Swtizerland, introduced its VK1-4 unit unit, shown by Battenfeld, were the



POLYETHYLENE pipe before (right) and after (left) biaxial orientation. Process, which permits thinner walls for given pressures, is joint development of Reifenhaeuser and Farbwerke Hoechst.

Reifenhäuser
opens New Fields in Extruder Design

This is the result of applying a system of pre-assembled and interchangeable units in the construction of our extruders, available with screw diameters of $1^1/_4$", $1^3/_4$", $2^1/_2$", $3^1/_2$", $4^3/_4$", and 6".

Our complete extrusion plants display also constructional components of the most advanced kind. They are noted all over the world for their high outputs, long and trouble-free working life, and economy in use. As complete productive units they serve for the processing of thermoplastic materials into:-

Sheets, pipes, profiles, mono-filaments, synthetic bristles, lay-flat film, cast film, embossed plastic sheets, and formed articles direct from the extruded sheet. We also supply equipment for the covering of cable, wire, and all other profiles.

Please contact our representative and discuss your extrusion problems with him.

General view of a Sheet Manufacturing Plant

Production of blown film; 11'6" wide lay-flat tubing

Extruder S 120 (4 3/4" screw diameter)

We have agencies in:-

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Austria
Argentine
Belgium
Brasil
Burma
Chile
China
Columbia
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Denmark
Ecuador
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France
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Holland
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Reifenhäuser KG
MASCHINENFABRIK

TROISDORF
West Germany

(photos below), which consists of a four-station extrusion manifold fed by the conventional extruder. Each of four extrusion dies is fed individually by separate melt metering pumps located at each of the four stations. Through the use of this extrusion manifold it is possible to run four separate extrusion jobs simultaneously from a single conventional extruder, and the entire setup can be controlled by a single operator. The unit may be set up for vertical (up and down) as well as horizontal take-off systems. Through the use of various attachments, this extrusion manifold can be used to produce blown film, monofilaments, pipe, and profiles.

Another interesting development shown by Oerlikon was the PL 100, (photos, p. 161) a complete extrusion coating set-up, with an output from 30 to 240 lb./hr., which features a vertically mounted 4-in. extruder suspended from overhead beams. Paper, metal, foil, cellophane, and textile materials can be handled in widths from 16 to 40 inches.

This machine unit is adapted to shear cutting and squeeze cutting, and the change from one system to the other is said to be quick and easy. The unit comes complete with take-up equipment, and a differential measuring device checks the coating thickness continuously.

One of the most impressive machinery displays was a complete line of Prodex extruders, (photo, p. 162), dies, and takeoff equipment now manufactured under license of Henschel-Werke, Kassel, Germany, for the European Common Market. The largest of the vented extruders has an 8-in. screw diameter, a maximum screw speed of 55 r.p.m., and an output from 1764 to 1984 lb./hour. The smallest has a screw diameter of 1¾ in., a top screw speed of 225 r.p.m. and an output from about 77 to 99 lb./hour. The full line of Prodex extruders is available with length/diameter ratios of 20:1; 24:1; and 30:1. The 24:1 and 30:1 types are vented for removal of volatiles.

These machines are also available with a wide variety of screw designs, each of which is specifically tailored to the requirements of both polymer and process.

Henschel also showed its new FM500A fluidizing mixer (photo, p. 162) for use in drying, dry-coloring, and dry-blending. Maximum capacity is 87 gallons. Like all other sizes in this series, it is equipped with a two-speed motor and can be run unheated or heated. Typical cycles are 6 to 7 min. for dry-blending and 1 to 2 min for dry-coloring. Appropriate electrical or steam-operated heat exchangers can also be supplied for heating.

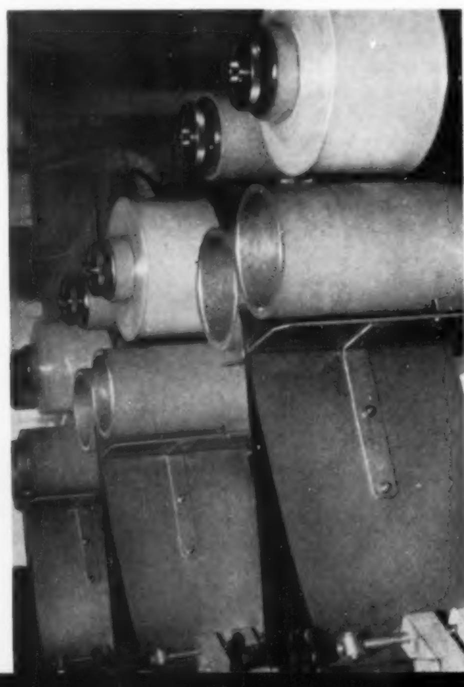
Frieseke & Hoepfner, Erlangen, Germany, exhibited its SP 150 (photo, p. 162), which has a screw diameter of 6 in. and a length-to-diameter ratio of only 3.5:1. The screw can be shifted back and forth to adjust extruder head pressure. The SP 150 is said to be particularly useful for the extrusion of profiles with large cross sections.

Improved versions of their high screw-speed—1500 to 3000 r.p.m.—friction-heated Model H (photo, p. 164) adiabatic extruders were exhibited by Alpine, Augsburg, Germany. Since the heat generated depends upon the viscosity of the material being processed, the extruder is inherently self-regulating in controlling the polymer melt temperature. The unit has a plasticating zone from one to three times the length of the diameter and, because of the higher speed at which the screw operates, is said to have a throughput two to three times higher than that of conventional slow-speed extruders of equal screw diameters. In addition, the time during which the thermoplastic material is retained in the extruder is considerably reduced because of the short plasticating zone and the high screw speeds. This is helpful when extruding heat-sensitive materials.

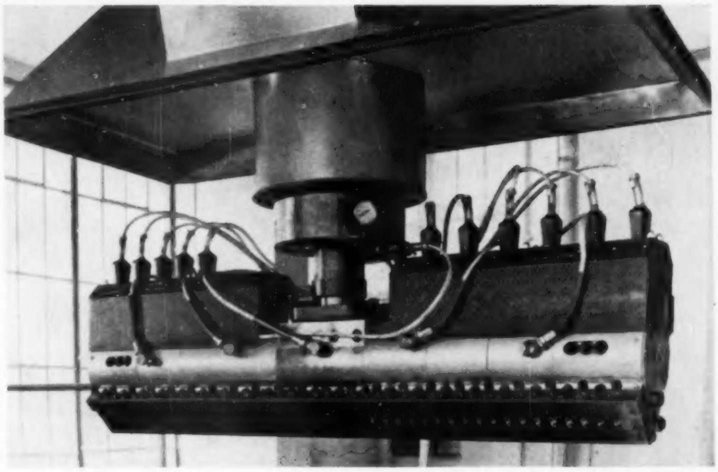
Designated the E2-58-102 and E2-58-64, two new improved twin screw extruders are now available from the Mapre Co., Diekirch, Luxembourg (photo, p. 166). The former is a 4-in. diameter twin screw machine and the latter is a smaller version with 2½-in. screws. Both machines are equipped with drives which permit infinitely variable screw speeds from 0 to 50 r.p.m. The twin barrels have been lengthened and can be equipped for venting and vacuum operation. Maximum output of the larger machine is 265 lb./hr. for shapes and 440 lb./hr. for compounding. For the smaller machine it is 132 lb./hr. for shapes and 220 lb./hr. for compounding.

L.M.P. (Colombo), Turin, Italy, showed its twin-screw RC 20, having 5-in. diameter screws; 14:1 length/diameter ratio; and screw speeds from 12 to 40 r.p.m. It is capable of plasticating up to 550 lb./hour. An interesting feature of this

BLOWN FILM being produced on Oerlikon VK1-4, a four-station extrusion manifold, with each die fed by separate melt-metering pump. At right is close-up of four take-up rolls.



COATING UNIT, Model PL 100, produced by Oerlikon has vertical extruder suspended from overhead beams. Close-up at right shows sheeting die mounted on 4-in. extruder nozzle.



machine is the screw conveyor feed system, which meters the granules to the extruding screw, thereby maintaining a constant volumetric feed. The Colombo line also includes twin screw extruders on the same principle as the RC 20, but with plasticating capacities of 33 to 88; 110 to 176; and 132 to 220 lb./hour.

The extruders shown by Battenfeld, Meinerzhagen, Germany, feature a specially tapered extruder screw which, by its action in relation to the extrusion cylinder, insures that a fully plasticated melt is fed homogeneously to the extrusion die. Two models were shown in Düsseldorf—the BE 60 (photo, p. 166), and the BE 120. The former has a screw diameter of 2.83 in. at the feed hopper, the front end tapering to 2.36 in. at the head. The speed of the screw is 8 to 60 r.p.m. Output is 70 lb./hour. BE 120 has a feed section screw diameter of 5.51 in., the front end tapering to 4.72 in.; a screw speed from 6 to 38 r.p.m.; and an output of 250 lb./hour. Both machines have a screw with a length/diameter ratio of 24:1.

Johann Fischer, Lohmar, Germany, exhibited several extruders. Its range of machines included screws having length/diameter ratios of 15:1, 20:1, and 25:1. The JFP 60, with a screw diameter of 2¼ in., is available with three screw lengths and is capable of processing from 22 to 88 lb./hr. with 15:1 screw; 11 to 154 lb./hr. with the 20:1 screw; and from 44 to 220 lb./hr. with the 25:1.

Hermann Berstorff, Hanover, Germany, manufacturer of extruders with screw diameters ranging from 1.18 to 18 in., featured its Model K 200, which is designed primarily for coloring, plasticating, and compounding; it is also suitable for the extrusion of large tubes, sheets, and profiles. It has a screw diameter of 7.87 in., a continuously variable screw speed from 11 to 50 r.p.m.; and will accommodate screws with ratios up to 20:1. The output of the K 200, generally ranges from 650 to 1750 lb./hr., but, according to the company, an output up to 2240 lb./hr. is sometimes possible. The machine can be designed for either steam or electric heating, and can be cooled by either water or air.

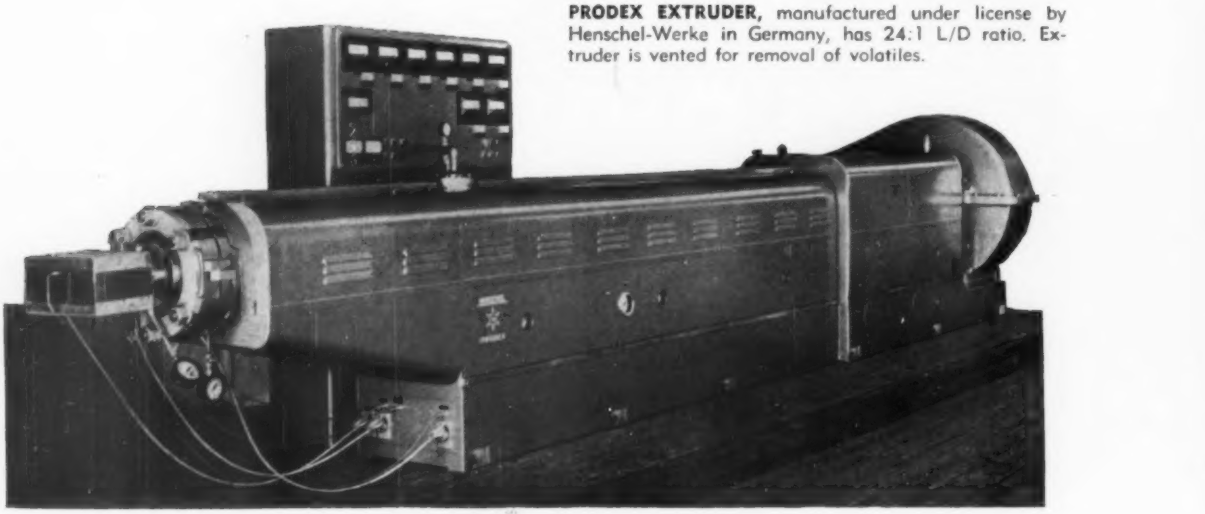
Also shown, was the Berstorff K-120 extruder with a bayonet-type crosshead locking device. Designed especially for wire coating with PVC or PE, this machine has 7 temperature zones; a screw diameter of 4.72 in., a L/D ratio of 20:1; and an output of 440 lb. per hour.

Berstorff also exhibited its high output GK 200 feed extruder for calendering, which is equipped with a double breaker plate. It has a screw diameter of 7.87 in. and is capable of processing about 2600 lb. per hour.

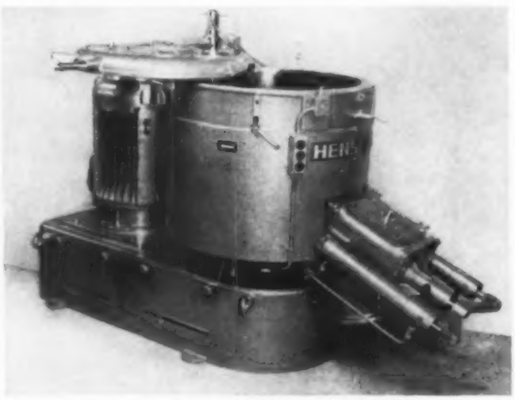
Blow molding

The machines consisted generally of refinements of equipment already well established in the United States, such as twin-head and four-head manifold machines. Production speeds are comparable to those found in the United States.

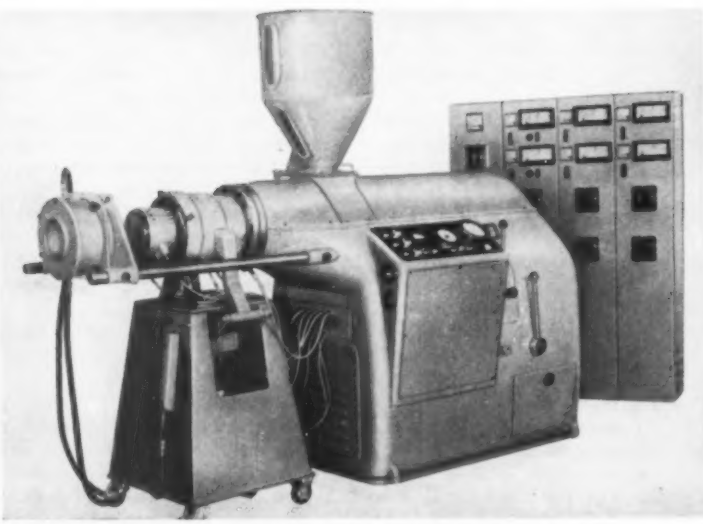
There was much activity at the stand of Kautex-Werk Reinhold



PRODEX EXTRUDER, manufactured under license by Henschel-Werke in Germany, has 24:1 L/D ratio. Extruder is vented for removal of volatiles.



FLUIDIZING mixer FM 500A made by Henschel, has maximum capacity of 87 gal.; can be run either heated or unheated.



SHORT-BARREL EXTRUDER, Model SP 150, made by Frieseke & Hoepfner, has a length to diameter ratio of only 3.5:1 and a screw that can be shifted back and forth to adjust head pressure.

Hagen, Hangelar, Germany, where a new, fast blow molding machine, fed from two dies, was producing salt and pepper shakers at a rate of 1400 per hour.

A development that will be featured on the 1960 Kautex blow molding machines is an infinitely variable mold closing stroke between 3 and 13 inches. This improvement means that the dry run from the blowing station to pick up the new parison can be kept to a minimum, and faster cycles for smaller pieces can be obtained.

Bekum, Berlin, Germany, manufactures fully automatic equipment which permits the use of either the tubular needle or the calibrating method, which forms the neck and produces a completely finished object in one operation. The machine works off an extruder manifold. When the mold opens at the end of a cycle, the blown item is automatically removed. (For photos of items blown on this equipment, see p. 168.)

Another of the company's twin blowing machines mounts two molds side by side; these molds are run simultaneously.

Small bottles or containers such as ampules, with a capacity of 1½ oz., can be produced on the Bekum equipment at the rate of 40 a minute. Tubes with a diameter of about 1 in. and a length of about 4 in. can be produced at the rate of 1200 per minute. Finished bottles with a capacity of about 6 cu. in. are blown at the rate of 500 per hr. per mold. By using the multiple set-up of the twin blowing equipment, up to 2000 such containers can be ready for shipment every hour, since no additional finishing of the

ALPINE model H friction-heated adiabatic extruder has 3:1 L/D ratio.

blown item is required when the calibrated system is used. This company's equipment is claimed to be particularly efficient in producing collapsible tubes. It is said to handle all varieties of thermoplastics, as well as rigid PVC.

J. Fischer, Lohmar, Germany, showed its BM 2000 blow molding machine to be used in conjunction with a type JFP 60 2½-in. extruder (photo, p. 168). The machine may be run either manually or automatically. When operation is automatic, it may be varied from 3 to 15 cycles per minute. The machine is designed for one blowing mold and can turn out articles with a maximum diameter of 5.1 in. and a maximum height of 11.0 inches.

A blow molding machine, made by Industrie-Werke Karlsruhe, Karlsruhe, Germany, and soon to be available commercially, was shown by Reifenhäuser. The extruder works continuously for more efficient blow molding. This machine is said to have an hourly production rate of 600 to 700 containers having a capacity of about 3 ounces.

It was rumored at the show that developments in bottle blowing machinery are moving toward techniques long used for glass and metal containers. Claims that rates of 100 1-qt. bottles per minute may be expected soon were heard, and there is reason to believe that such machinery will be developed in the near future. This emphasis on high speed in Europe is undoubtedly influenced by the American market requirements. However, it should be kept in mind that efforts of U. S. manufacturers are currently being directed toward achieving the same production goal.

Thermoforming

A new development which will give a further boost to the use of plastics in packaging was revealed for the first time at Düsseldorf. Hydro-Chemie, Zurich, Switzerland, created a stir with its Formpack R-4 (photo, p. 168). This machine will form and trim 240 drinking cups with 6- or 7-oz. size every minute, from a 10- by 12-in. sheet using a 12-cavity mold, cycling every three seconds. This means about 15,000 such cups per hour. By utilizing the maximum amount of formable area, the waste is kept to 15 to 20%, depending upon the design of the cup.

The unit is comprised of a four-station rotary, fully automatic, stack- or roll-fed machine, with two heating stations with adjustable heaters; one forming station; and one vertical trimming station. The formed pieces and trim are ejected separately, the trim being automatically removed by grips.

This machine is probably the most versatile in its field: it will mold into a female mold, with or without plug assistance, or over a male mold, with or without the use of air slip techniques. It will mold to a depth of 7 in. by either method and the depth-to-diameter ratio is limited only by the forming characteristics of the material. Items with undercuts as well as cups with beaded edges may be produced. No additional operation or losses of cycling time are involved. The machine molds any thermoformable film or sheet; oriented or non-oriented. The company notes that the fast cycling makes for more uniform walls.

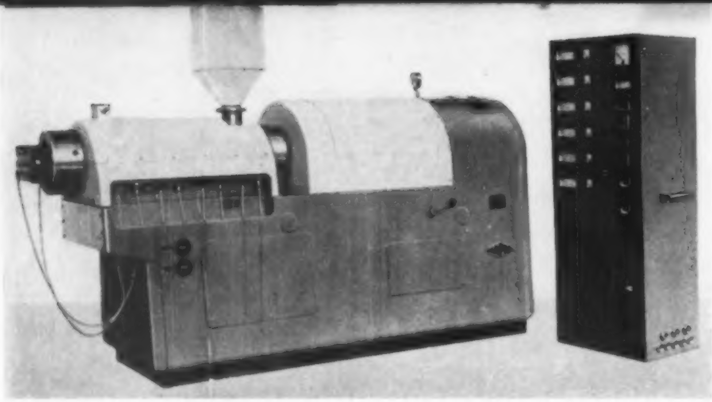
Another highly efficient machine shown by Hydro-Chemie was its Formseal, which produces containers for such items as individual portions of marmalade or jelly, performing all operations from heating the sheet to the sealed and filled package. Briefly, it works as follows: the sheet is heated and formed and travels to a station where it is filled. It is then taken to the next point where the lid is sealed onto the filled container; the complete package is then die-cut from the formed sheet, ejected, and stacked. The maximum forming area of this machine (photo, p. 169) is 10 by 10 inches. A typical minimum cycle is 3.6 sec. or 1000 items per hour; typical maximum cycle is 16 sec. or 400 packages per hour.

The principle of the rotary printing press was applied in the design of the RVI machine, exhibited by Alkett, Berlin, Germany. (Photo, p. 169.) This machine eliminates the closing frame used on conventional vacuum forming machines to hold the sheet air-tight. In the Alkett process, the plastic material is fed to a rotating drum under tension. The sheet travels over the rotating drum which is fitted with a die. Depending on the shape to be formed, the die can be either shallow or deep, with a number of small holes located in the depression. A vacuum is pulled inside the drum and the sheet is pressed evenly against the die by atmospheric pressure. Infra-red heaters are used to soften the plastic sheet. After forming is complete, air is used to cool and harden it. The formed sheet can then be coiled, or can be trimmed to the desired sizes. Sheets up to 59 in. wide can be handled at speeds up to 33 ft./minute. Sample production rates per minute are: 1080 lids for margarine containers; or 2200 lids for marmalade jars; and up to 16,445 suppository packages. The Alkett machine can be modified for forming, filling, sealing, and die-cutting complete packages, such as the familiar individual jelly packs.

Bastert-Werke, Bielefeld, Ger-

SCREW CONSTRUCTION in Werner & Pfleiderer's ZSK 120/1500 extruder permits changes of overall screw design to suit processing needs.

Figures of Dresden china — some of them almost 250 years old — are treasured for their attractive forms and delicate colors. The style of these old German figures is highly rococo . . . with moods that vary from the decoratively dignified to the broadly humorous. Today when you look at Dresden china in homes or collections the colors seem as appealing and fresh as the day they were fired in the kiln.



TWIN-SCREW EXTRUDERS manufactured by Mapre have drives which permit infinitely variable screw speeds from 0 to 50 r.p.m.

many, exhibited a machine (photo, p. 172) which vacuum forms more than 230,000 3-in. diameter lids in an 8-hr. shift, using 24-cavity molds. This machine consists of 10 forming stations rotating about a central axis, with each station constituting a complete vacuum forming unit that operates automatically.

Among several automatic rotary forming machines shown by CoVema, S.r.l., Milan, Italy, the Cutform 302 is especially interesting. This machine is a vertical type which combines vacuum and mechanical forming, cutting, and ejection of the formed articles in a continuous automatic operation. It produces from 2000 to 20,000 pieces per hour, depending upon the size of the item. Feed rolls of material may be changed while the machine (photo, p. 172) is operating. It has a forming depth of 5 in., and handles rolls about 14 in. wide.

Printing machines

The important progress made in printing on plastics for packaging will be discussed in a forthcoming issue of MODERN PLASTICS, including printing on bottles, tubes, and conical containers. Here, briefly, are some of the new developments.

Bastert-Werke, Bielefeld, Germany, introduced a machine for automatic three-color printing on conical containers at the rate of 3000 per hour. A vacuum suction cup picks up the container from a stack; which is then positioned over one of 12 rubber mandrels arranged in star pattern around a revolving drum. Rotation of the drum brings each mandrel with its plastic container once over each of three color stations. Next, each container passes over an airdrying station before the next printing station is reached. After the three colors have been printed, suction arms remove the container and stack it.

B. Grauel & Co., Berlin, Germany, exhibited a flatbed printing machine for printing on flat surfaces in three colors by dry offset. Operation is fully automatic and accessories are available to permit printing on curved surfaces, including bottles.

Two models are currently available: the R1 MF-3F, which has a printing area of about 6¼ in. square and can print some 800 to 900 units per hr.; and the RS-3F, which has a printing area of 11¹³⁄₁₆ by 15¾ in. and can print between 500 and 600 parts per hour.

B. Grauel also exhibited a very compact offset machine for overprinting pen and pencil refills at the rate of 5000 to 15,000 per hour. The printing area is 3½ in. long on items with a diameter up to 5⁄16 inch. Articles to be printed are first dumped into a hopper and automatically fed to the printing unit, where they are rotated against the printing cylinder. The imprint is sharply defined, and the register is extremely accurate, even when involving very small diameters.

Thermoset molding

Although many compression molding machines at the exhibition were still designed for manual operation, several manufacturers are now offering a range of fully automatic machines. In general, too, presses are more compact and of neater design than was previously the case.

Battenfeld, Meinerzhagen, Germany, displayed several automatic compression molding machines designed to handle most types of thermosets, including materials with a variety of fillers, (photo, p. 174). An interesting feature of these machines is that they are open on three sides and the molding operation is considerably simplified.

The largest of the Battenfeld automatic presses, Model P, has capacity of about 200 tons; the same model with a transfer molding device has an injection pressure of 80 tons; and the stroke of the injection piston is 5⅞ inches.

Battenfeld also displayed its BRP 4/2, a fully automatic multi-press unit designed for the production of bottle caps and other small and medium-sized threading moldings. This machine consists of four press units placed in a row and having a compression range from 0.2 to 2 tons, each independently adjustable, so that it is possible to work with four different materials or colors simultaneously. The BRP 4/2 is capable of molding up to 800 items per hour. Compression capacity—about 2 tons.

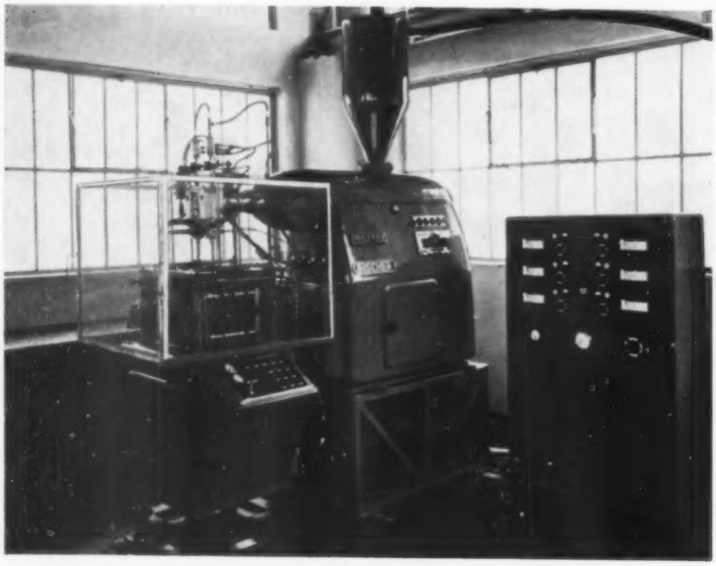
Bucher-Guyer, A. G., Niederweningen, Switzerland, displayed several automatic high-frequency preheated compression molding machines up to 500 tons. These machines created a lot of interest because of their compactness and neatness of design.

Miscellaneous

A new adiabatic plasticator, called the PK 100/V was shown by Werner & Pfleiderer, Stuttgart, Germany. The processing part of this machine consists of a tapered rotor which re-

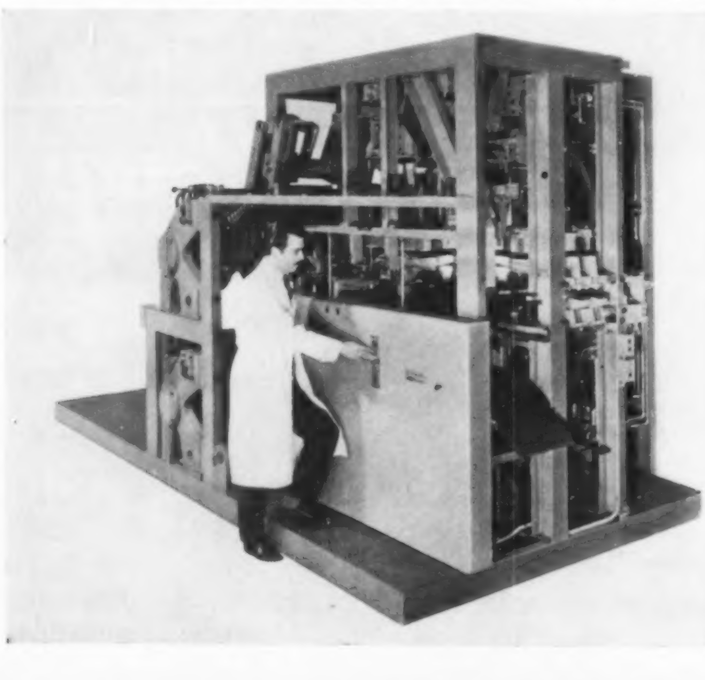
BATTENFELD EXTRUDERS have a specially tapered screw designed to plasticate the material completely before it reaches the die. All electrical control instruments for the extruder are located in built-in cabinets.

ARTICLES blown on Bekum equipment. At left is unfilled polyethylene tube; in center, acetate lighter fluid container; at right, filled PE tube.



J. FISCHER Model 2000 blow molding machine can be run manually or automatically. Accommodates single mold to turn out articles up to 4.72 in. diameter, 10.2 in. high at up to 15 cycles per minute.

FORMPACK R-4, produced by Hydro-Chemie, turns out up to 15,000 drinking cups per hour. Finished items are ejected through inclined chute where they are collected in containers, or they can be dropped into hopper for sorting and stacking, or be taken away by conveyor.



volves at a constant speed in a concentric conical barrel, which intensively shears the material and generates the heat required for fusion. This results in a short processing time, because melting takes place in about 25 seconds. The dwell time in the following screw section is also very short. The machine can handle any PVC formulation containing from 5 to 50% plasticizer, and has an output of 260 to 400 lb. per hour.

Hermann Berstorff, Hanover, Germany, displayed a laboratory calender with four rolls in an L-type arrangement, and designed primarily for the production of rigid and plasticized PVC sheets. Speeds of each roll can be controlled separately. The take-off speed ranges from 8 to 80 ft./min.

Another unit shown by Berstorff was a laboratory two-roll mill with variable speeds from 11 to 50 r.p.m. The speed of each roll is separately adjustable to obtain various degrees of shearing action. Gap sizes are controlled by adjusting the front roll.

Karl Hennecke, Birlinghoven, Germany, displayed a metering and dispensing machine especially developed for phenolic foam. These foams are no more evident in Europe than they are in the United States, but perhaps some pioneering in technology may make these materials more serious contenders for structural uses.

Fecken-Kirfel, Aachen, Germany, and Baeumer, Freudenberg, Germany, displayed a range of slitting equipment for flexible foams including machines for the continuous production of corrugations and convolutions, which mechanically produce in slab stock some of the physical characteristics of cored structures of molded foam.

Various hot wire cutting machines for the production of foam profiles were shown by Alkett, Berlin, Germany. The importance of this process lies in the fact that directly molding foams to shape—especially urethane—is not easy, and this method is a simple and versatile technique for producing various configurations from slab stock. The Model ETR 1 permits the continuous production of bars, strips, etc., and other profiles for insulation, seals, etc., in lengthwise cuts from materials up to 5 in. wide by 10 in. high, and of any length. Changeover of profiles is simple and rapid.

The company also supplies another machine, the ETR 3, for cutting flat profiles in a horizontal direction. This model consists of hot wires placed across a table on which the foam blocks are conveyed into the required position. The machine can

handle material up to 20 in. high, 78 in. wide, and of any length.

Krauss-Maffei, Munich, Germany, is offering a new heavy-duty intensive mixer, called the PM 50; mixing chamber capacity is about 19 gallons. The kneading rotors are supported from one side only. A front door provides easy access to the mixing chamber. Feed ram and front door are operated automatically. The batch size for PVC dry blends is up to 3300 lb./hr. on a manual cycle and up to 4400 lb./hr. on semiautomatic cycle.

A new compounding machine exhibited by Krauss-Maffei combines a double-worm extruder and an intensive mixer, for continuous mixing and compounding. Low-pressure polyethylene can be processed at the rate of 882 lb./hr. and PVC at the rate of 1764 to 1984 lb./hour.

A large granulating machine which can process up to 4410 lb./hr. was shown by Fellner & Ziegler, Frankfurt, Germany. This machine cuts 60 strands with a diameter up to 0.2 in. into uniform granules at a rate of up to 120 yd. per minute.

Several machines still under development were exhibited by E. Kampf, Bielstein-Mühlen, Germany, including one for bi-axially orienting film continuously at starting speeds from 30 to 60 ft. per minute. Another development is a cellophane or plastics film cutting, slitting, and winding machine which is fully automatic, with tension controls and speeds up to 1700 ft. per minute. Maximum rewind diameter is 20 in., and working widths up to 64 in. can be handled.

Aust & Schuettler u. Co., Düsseldorf, exhibited its new BK III MAS fiber-resin spray equipment, designed for building applications. The unit consists of two resin containers, each with a capacity of 110 lb.; a solvent container with a capacity of 68 lb., and can be used with a special mixing and metering device which feeds the fillers separately into the fiber-resin jet. According to the company, fillers of any grain size and specific weight can be processed with the special unit, including quartz powder, corundum, carborundum, granulated pumice, cork powder, pre-expanded mica, and granulated foams. This new device is also employed for coating streets with a nonskid surface.

MATERIALS AND APPLICATIONS

Cooperation between materials suppliers and machinery makers, so noticeable at the Plastics Exposition in Chicago, Ill. last November, was also in evidence in Düsseldorf and was undoubtedly responsible for some of the most spectacular developments on display.

CONTAINERS for individual portions of jelly and the like are produced by Hydro-Chemie's Formseal in one pass. The unit performs all operations, from heating sheet to sealing package.

Polyvinyl chloride

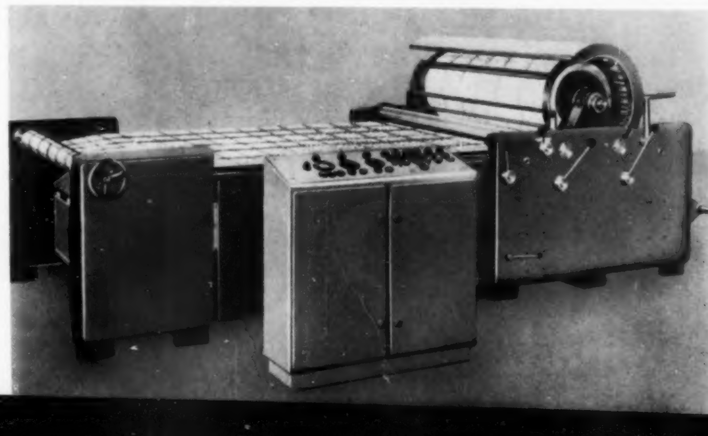
Honors for the most significant contributions to the further growth of PVC should probably be divided between the machinery manufacturers who developed processes for producing corrugated unplasticized, rigid PVC sheeting, and Farbwerke Hoechst, whose new raw material—Hostalit Z, a blend of PVC and chlorinated polyethylene—was shown in a wide range of applications which are in commercial production.

Both Reifenhäuser and L.M.P. (Colombo) Turin, Italy, have developed special machinery to produce the corrugated sheeting for the building field. (See photo, p. 176.) Four manufacturers in Germany have already been licensed by Colombo and the process is also licensed in other European countries. Roofing and other outdoor applications made possible by this development will be fully described in a forthcoming issue.

The high impact properties of Hoechst's Hostalit Z have resulted in its use in sheet form, for vertical surfacing, such as closet doors. Unlike decorative melamine laminates, Hostalit Z is said to be easily applied, even by the do-it-yourselfer, and thus would seem to be a strong contender for markets where difficulty of application have held back use of melamine laminates. Vaccum formed nameplates and automobile number plates were also exhibited. According to one company, this material may soon be used in the Volkswagen for crash panels.

Venetian blinds made from interlocking extruded **(To page 172)**

ALKETT'S RVI vacuum forming machine eliminates closing frame used on conventional forming equipment by having sheet fed to rotating drum under tension.

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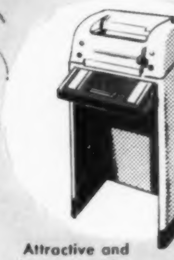

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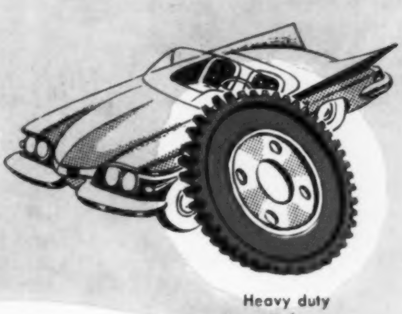

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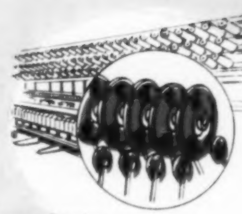

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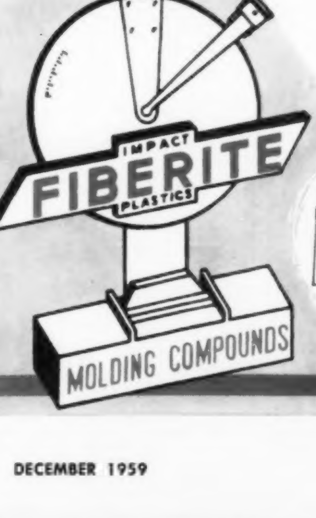

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plasticized PVC profiles have gained wide acceptance in Europe. One company produces completely assembled venetian blinds at a rate of from 6 to 8 ft. per minute.

A. Hagedorn & Co., Osnabrück, Germany, who reportedly has a process for extruding unplasticized PVC sheet, exhibited vacuum formed containers for food which are said to meet German food laws and are used for packaging margarine.

Wire for fences, covered with extruded PVC to provide protection in corrosive environments, were shown by Chemische Werke Hüls, Marl, Germany. One large chemical company has used this material in perimeter fences for its vast manufacturing area, and has saved substantial amounts by consequent reduction in replacement costs.

The European preference for reusable rather than disposable materials has also opened a large market for laminates of PVC films reinforced with webs of rayon, nylon, or polyester fibers. This film is fabricated into tarpaulins for industrial, building, and agricultural uses, applications for which disposable PE film is used in the United States.

Vinyl sheeting laminated to urethane foam is widely used for automobile interiors and J. H. Benecke, Hanover, Germany, has developed a wide range of mechanically perforated, breatheable upholstery covering. This company has also developed a process for full-color reproduction of photographs on PVC curtains which offers a variety of new design possibilities.

Another interesting application was a blow molded, flameproof PVC gasoline container shown by Plasticwerke Pechthold, Mudau, Germany. This canister is available in capacities ranging from 2.6 to 5.3 gal. and has a polypropylene closure.

A model home which formed the booth of Dynamite AG, Troisdorf, Germany, demonstrated the wide range of decorative vinyl sheeting produced by this company, and also the effectiveness of high impact PVC in vertical applications, ranging from complete wall coverings to a variety of furniture applications.

Vinyl-metal laminates, which enjoy such spectacular growth in the United States, still seem to be in their infancy in Germany, where luggage and similar applications are still largely produced from vinyl sheeting, laminated to wood, aluminum, and other shells.

Nylon

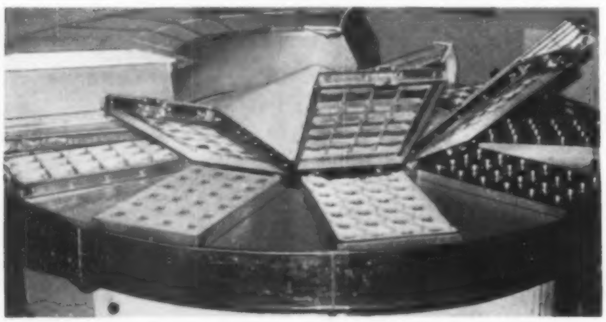
European manufacturers, it seems, frequently prefer to use nylon appliance housings, where U. S. manufacturers would choose a less expensive material.

Several German manufacturers use nylon-6 (caprolactam) and nylon-11 (Rilsan) for vacuum cleaner housings. Battery cases, safety helmets, photographic flashlight equipment, and miners' lamps were among products featured by Farbenfabriken Bayer, Germany. Nylon has also replaced metal for automotive fans in the Auto-Union cars, and it is used as an indicator light unit for the Dauphin automobile. Organico S.A., Paris, France, manufacturers of Rilsan, also featured electric fans, kitchen sink units, and blow molded bottles of various types at its booth.

Lay-flat Rilsan film is used for packaging of foodstuffs in France. Ham, sausages, and other meats can reportedly be packed under vacuum and then sterilized in this package; also used for frankfurter skins.

Polycarbonates

In Germany, as in the United States, polycarbonates are still among the more expensive plastics. Nevertheless, Bayer displayed a number of commercial applications where the good heat resistance, transparency, and weatherability of PC provide economies which offset the higher raw material cost. For example, in Germany and Holland, several authorities have installed formed polycarbonate street light globes that are said to be more economical than glass. Also, injection molded covers

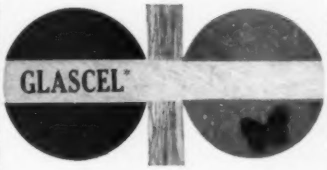


TEN-STATION rotary forming machine can produce more than 230,000 3-in. diameter lids in an 8-hr. shift, using 24-cavity molds. Unit is produced by Bastert-Werke. Each station constitutes complete forming unit.

CUTFORM 302, made by Covema, is vertical vacuum forming machine that forms, trims, and ejects the finished pieces automatically.

Solving unusual problems with Riegel papers...

Glass reinforcing material made on Paper machine!



Riegel's Glascel* is a thought-provoking new impregnating paper for plastic laminates. As a reinforcing material it gives better uniformity and *lower cost* than other non-woven glass materials . . . and higher strength than ordinary saturating papers. Glass content is variable from 5% to 90% to give just the right strength for each job. Long rolls, many weights, widths to 65 in.

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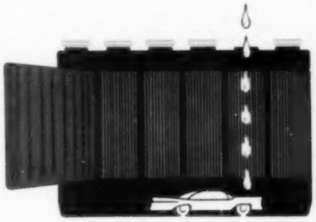
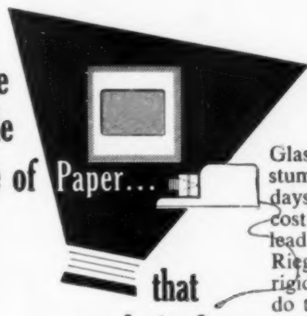


The little piece of Paper... that popularized color photography



Glass slide mounts were a stumbling block in the early days of color photos. They cost more than the film! A leading manufacturer asked Riegel: "Is there a paper rigid and tough enough to do the job?" That was the birth of the present-day paper mount. Major breakthrough was its special heat-seal coating. Though very thin, it sticks quickly at low heat.

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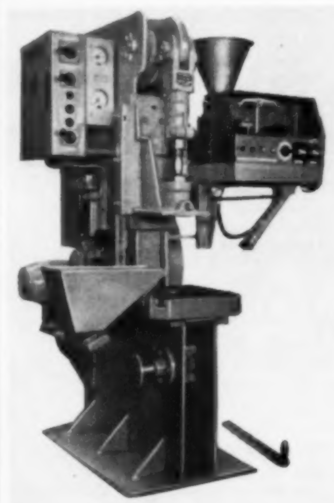
TECHNICAL PAPERS FOR INDUSTRY

for switchboards and control cabinets, weighing about 2 lb., permit inspection and at the same time provide the necessary protection of sensitive parts. Bayer's Makrolon polycarbonate resin is being tested for printed circuits.

Among lighting and optical uses for these resins are signal lights of all types; fluorescent tube sockets; reflectorized street signs (vacuum



BATTENFELD automatic compression molding machine eliminates the use of tie bars and mold area is open on three sides. All controls are conveniently mounted on the machine.

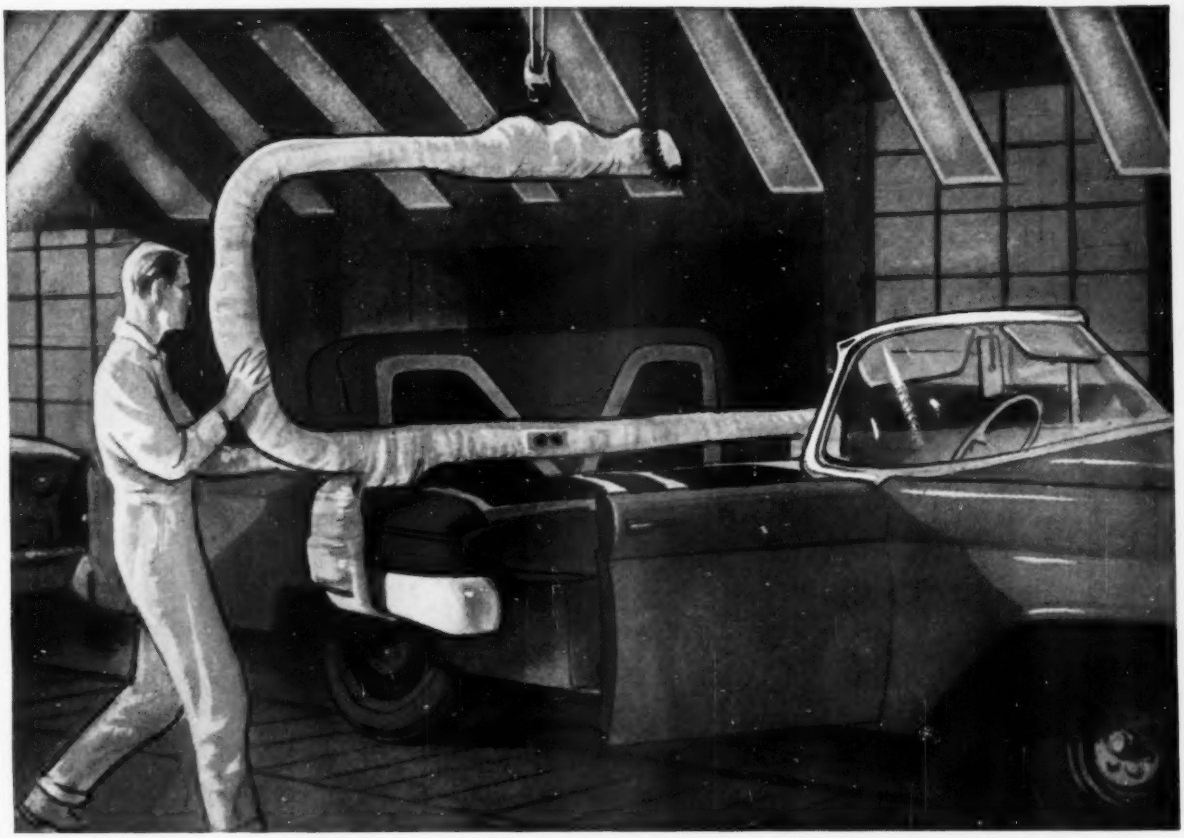
formed); and camera and exposure meter housings.

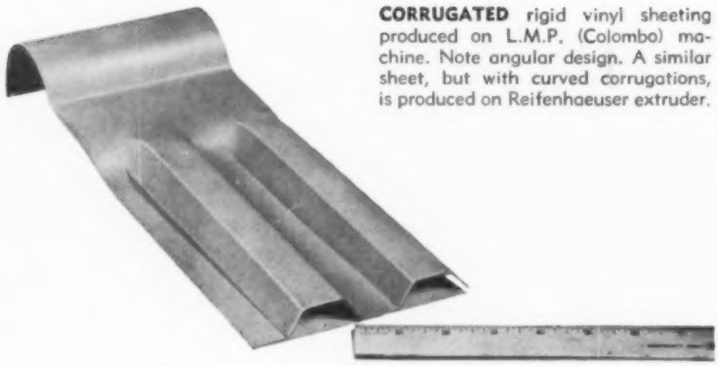
Other products already on the market include technical drawing equipment such as set squares and protractors, slide rules and stencils for architectural drawings; lids and covers of all types; baby bottles; mixer housings; and hair curlers.

A new application for polycarbonates is as a technical photographic film with good dimensional stability. PC film can be oriented, vacuum formed, and metallized. According to some German manufacturers, it is going to compete with Mylar in many applications.

Reinforced plastics

In general, fibrous glass reinforced plastics materials shown in Düsseldorf gave evidence of a well diversified and highly competent industry. At the Bayer booth, a container with a capacity of 3960 gal. showed a beautiful finish. Reichhold Chemie, A.G., Hamburg, Germany, displayed





CORRUGATED rigid vinyl sheeting produced on L.M.P. (Colombo) machine. Note angular design. A similar sheet, but with curved corrugations, is produced on Reifenhaeuser extruder.

an unsinkable lifeboat about 24 ft. long and capable of supporting 48 persons. (See "Survival gear," MPl, Sept. 1959, p. 150.) Another large exhibit was a rectangular, domed roof light measuring about 20 by 6 ft., and manufactured by Deutsche Tafelglas-AG., Fürth, Germany.

Aachen-Gerresheimer Textilglas, GmbH, Düsseldorf, Germany, displayed curved and angular reinforced plastics profiles up to 12 in. across manufactured by a continuous vertical drawing process at the rate of 20 to 30 yd. per hour. The tensile strength of the finished product is said to be 21,330 p.s.i. in the drawing direction; and 8530 p.s.i. cross-directionally. In volume, the profiles are in the price range of aluminum in Germany and are expected to be used for switchboards in the electrical industry, as window frames, panel frames, lighting fixtures, and boat building.

A reinforced plastics chain produced in such a way that each link is a complete unit with no joints and that the separate links are interlocked in the conventional manner was also exhibited at the booth. These lightweight chains are able to support loads up to 1000 lb. and offer good corrosion resistance, particularly against sea water.

RP window frames in all sizes and conventional designs with a polystyrene foam core and with a high gloss surface in various colors were shown by Polymatic, Nuremberg, Germany. These frames provide a high degree of insulation and are said to prevent condensation. This construction reportedly makes it possible to use plastic window frames in sizes which can normally be obtained only with metal frames.

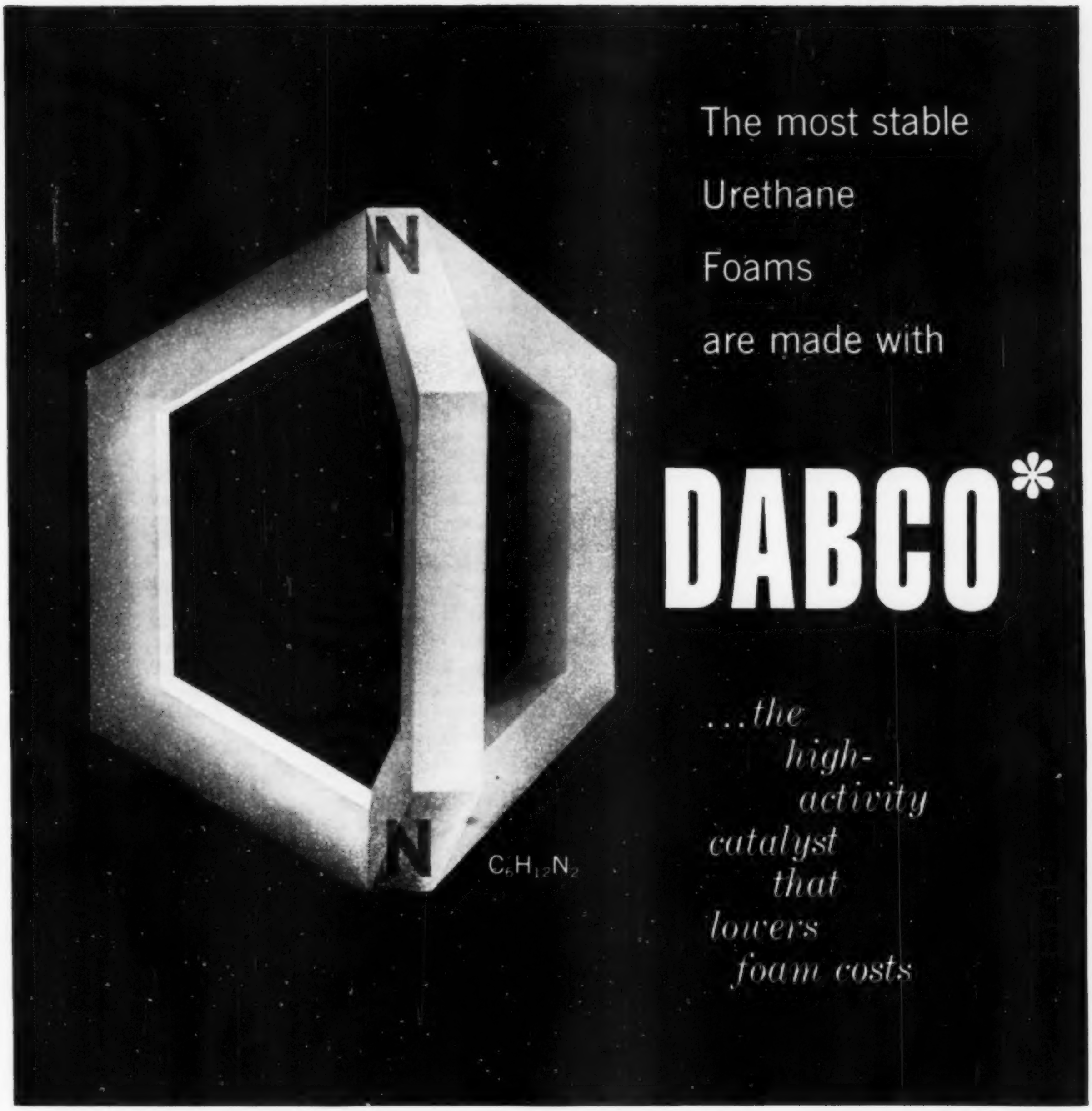
Polyolefins

High-density PE production facilities which BASF, Ludwigshafen, Germany, owns jointly with Shell International Chemical Co., London, England, will have an annual capacity of 165 million lb. by the end of 1960. This is expected to reach 265 million lb. annually by 1962. These figures represent the total anticipated production for high-density PE in Germany, since ROW, the jointly-owned company, is the sole producer and is said to be protected by patents well into the 1960s.

Molded PE products exhibited at the show did not differ markedly in range or design from those commonly found in the United States.

Foams

An exceptionally broad range of both rigid and flexible PVC closed-cell foam produced by a high pressure mechanical mixing method was


The most stable
Urethane
Foams
are made with
DABCO*
...the high-activity catalyst that lowers foam costs
N
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C6H12N2

shown by Lonza, Basle, Switzerland, and Weil, Germany. Hüls, a raw material producer, also showed open-celled, flexible PVC produced by a low-pressure mechanical mixing process. Flexible PVC foams with an embossed, laminated vinyl sheet surface are widely used for gymnastic equipment and tumbling mats. Other applications include shoulder pads for rainwear, where the closed-cell material is said to be particularly advantageous. Rigid PVC foam is used for flotation purposes and also in sandwich constructions together with reinforced plastics sheets. It is used in lifeboats, and as insulation material in tank cars. The European material had a particularly good appearance, uniform cell structure—in very fine and coarse types—and was essentially odorless.

Urethane foams in Germany are still largely of the polyester type, even for furniture applications. Polyether raw materials have recently been introduced by Bayer, but in a much more limited range than those available in the United States. There is every indication that fibrous reinforcements will be used to support the foam core in sandwich constructions.

Polystyrene foam is used widely in building, packaging, and insulation of every type. BASF has done impressive market development work, and Deutsche Frigolit, Worms, Germany, showed a range of molded polystyrene foam items and industrial insulating installations, which indicates that many of the large volume uses that are only now beginning in the United States have already been widely accepted in Europe. Frigolit included in its display a material with a density of below 0.7 lb. per cu. foot.

Melamine

New techniques involving decorative foils, including a wide range of attractive colors and designs, especially for deep draw items, displayed by Ornapress A.G., Zurich, Switzerland, demonstrated that a virtually untapped market exists in addition to dinnerware. This company has introduced foils into the novelty and premium fields, and into the appliance field, where decorated knobs and instrument dial plates produced by the molded foil technique have proved superior to rubbed-in paint processes.

General

Phenolic molding compounds modified with melamine were shown by Resart-Ges., Mainz, Germany. These compounds are stated by the supplier to combine certain good properties of phenolics with the broad range of coloring potentialities of melamine.

Mikro-Technik, Miltenberg, Germany, has developed a process for regrinding and purifying polytetrafluoroethylene waste so effectively that finished articles made from this regenerated scrap are said to possess all the properties demanded of virgin PTFE.

New types of alkali-resistant unsaturated polyester resins have been introduced by BASF. These resins are expected to find a large market in the container field.

A termite-repellant additive said to be particularly effective for long periods in plasticized PVC has been introduced by Bayer. Present applications include cable insulation, vehicle upholstery and cinema seating. It is easily soluble and is added to the plasticizer in amounts from 2.5 to 3.5%, based on the total PVC-plasticizer mixture. Subsequent processing is carried out in the usual manner.—End

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A report on the three conferences held in conjunction with the Duesseldorf Show is scheduled for publication in our January 1960 issue.

S.P.E. conference

(From pp. 124, 129)

moforming Molds for Linear Polyethylenes." *R. Doyle and D. E. Allison, Phillips Chemical Co.*

"Summary of Thermoforming Techniques," *Robert E. Kostur, Comet Industries.*

"Requirements, Properties, and Testing of Extruded High Impact Polystyrene Sheets." *R. George Hochschild, Koppers Co., Inc.*

Session 19: Foams. *Moderator: Charles B. Sias, Pittsburgh Plate Glass Co.*

"Controlled Density Polystyrene Foam Extrusion." *Fred H. Collins, Dow Chemical Co.*

"The Use of Extenders in Flexible Urethane Foams." *T. E. Ferrigno, Minerals and Chemicals Corp. of America.*

"Recent Developments in Rigid Polyurethane Foams." *Louis R. LeBras, Pittsburgh Plate Glass.*

Friday morning, Jan. 15

Session 20: New materials, Part II. *Moderator: Dr. Robert L. Patrick, Continental Can Co. Inc.*

"Organo Phosphorous Epoxide Copolymers." *L. M. Kindley, Melpar Inc.*

"Zerlon 150-A Product of Copolymer Chemistry." *A. L. Bird and T. C. Broadwell, Dow Chemical Co.*

"The Impact of Pro-fax on the Injection Molding Market." *R. D. Ullrich, Hercules Powder Co.*

"Polypropylene Industrial Fibers." *G. L. McIntyre and W. J. Craven, Enjay Laboratories.*

Session 21: Industrial design and coloring. *Moderator: Joseph Palma, Jr., Palma-Knapp Associates.*

"Structural Design with Plastics." *E. Baer, J. R. Knox, T. J. Linton, and R. E. Maier, E. I. du Pont de Nemours & Co.*

"An Aesthetic Approach to Thermoplastics in Architecture, Art, and Interior Decoration." *A. G. Winfield, DeBell & Richardson.*

"Coloring Linear Polyethylene." *P. E. Campbell, R. J. Martinovich, and T. V. Gay, Phillips Chemical Co.*

"Safety of Colored Plastic Packaging for Food." *G. W. Engle, Monsanto Chemical Co.*

Session 22: Radiation and Missiles. *Moderator: Robert F. Ouimette, Minneapolis-Honeywell Regulator Co.*

"Neutron Shielding with Linear Polyethylene." *D. E. Setter, Phillips Chemical Co.*

"Plastics for Atom Smashers." *James O. Turner, Lawrence Radiation Lab, U. of Calif.*

"Technical Capabilities and Development in Engineered Missile Hardware." *J. J. Mobilia, Raytheon Mfg. Co.*

Session 23: Rheology. *Moderator: Dr. James F. Carley, Dept. of Chemical Engineering, University of Arizona.*

"Effect of Hydrostatic Pressure on Polyethylene Melt Rheology." *R. F. Westover, Bell Telephone Laboratories.*

"Stress Relaxation and Creep Measurements on Some Thermoplastic Materials." *R. L. Bergen Jr. and W. E. Wolstenholme, Naugatuck Chemical Co.*

"Cause of Melt Fracture and Its Relation to Extrusion Behavior." *R. M. Schulken Jr. and R. E. Boy Jr., Tennessee Eastman Co.*

"Melt Flow Properties of Linear Polyethylenes." *A. P. Metzger and C. W. Hamilton, Battelle Memorial Institute.*

Standby Papers:

"Developments in Finishing Molded Plastics by the Roll Leaf Stamping Method." *Martin A. Olsen, Olsenmark Corp.*

"Isophthalic Polyester Resins—Results of Extensive Field Testing in Specific Applications." *Robert E. Park, Pittsburgh Plate Glass Co.*

"Reinforcing Fillers." *T. H. Ferrigno, Minerals & Chemicals Corp. of America.*

"Fluidized Bed Coating with Vinyls." *R. J. Borsh, Union Carbide Plastics Co.*

Society of Plastics Engineers Committee members responsible for the 16th ANTEC include: T. A. Bissell, national SPE ex. secy.; G. M. Baccash, vice chairman arrangements; K. A. Kaufmann, speakers; Franklin L. Fine, general chairman; C. M. Waugh, vice chairman program; R. E. Daniels Jr., treasurer; Benjamin F. Brown, catering; James Steiner, visual aids; H. A. Doolittle, finance; M. A. Self, publicity; W. N. Woodruff, house arrangements; W. F. Brown, ticket sales; Harold A. Holz, reception Sgt.-at-arms; L. A. Bernhard, mgr., national SPE administrative department; K. A. Rouzer, secy.; E. Wilson, printing; and R. Reynolds, ladies program.—**End**

Reinforced plastics conference

Program of 15th annual session, to be held Feb. 2-4, 1960, at the Edgewater Beach Hotel, Chicago, Ill.

Registration for the 15th Annual Conference of the Reinforced Plastics Div. of The Society of the Plastics Industry Inc., will begin at 1:00 p.m. on Monday, Feb. 1, 1960. The tentative conference program is as follows:

Tuesday, February 2

9:30 A.M. to 12:00 Noon—Concurrent sessions on Aircraft and Missiles; Consumer Products; and Design, Part I.

Session I—Aircraft and Missiles

Presiding: Samuel S. Oleesky, Zenith Plastics Co.
Vice Chairman: T. B. Blevins, Dept. of the Army, Office of the Chief of Ordnance.

"Design, Fabrication, and Erection of the 140-ft. Diameter Paper Honeycomb Core Sandwich Radome," George C. Fretz, Goodyear Aircraft Corp.

"Why Reinforced Plastic Parts for Redstone Missiles," H. W. Haugan, Missile Div., Chrysler Corp.

"High Temperature Plastics, Current Capabilities and Future Prospects," Harry Raech Jr., NORAIR, a Div. of Northrop Corp.

"Technical Capabilities and Development in Engineered Missile Hardware," John J. Mobilia Jr. and D. V. Rosato, Raytheon Mfg. Co.

"High Temperature Plastic Materials for Missiles," Ray Cutler and C. S. Brown, H. I. Thompson Fiber Glass Co.

Authors' Panel Discussion.

"Control of Variables in Heat Resistant Glass Reinforced Plastics," Ralph H. Sonneborn, Allan B. Isham, and Frank W. Dennen, Owens-Corning Fiberglas Corp.

"New Concepts in the Manufacture of Fiber Glass Ducts (and Potentials for Filament Winding Applications)" N. K. Hankins, Rezolin Inc.

"Effects of Transient Heating on Structural Plastic Materials," Rex W. Farmer, Wright Air Development Center.

Session II—Consumer Product

Presiding: Donald G. Estey, American Cyanamid Co.
Vice Chairman: Kenneth L. Ditzel, Lucidol Div., Wallace & Tiernan Inc.

"Development of a Glass Fiber Reinforced Firearm Barrel," Joseph W. Silva, Olin Mathieson Chemical Corp., Winchester-Western Div.

"Low Pressure Decorative Laminate (Continuous Contact Pressure Decorative Laminate)" M. Elber Latham, Swedlow Inc.

"Two Unique Plastic Helmets," A. L. Alesi and M. I. Landsberg, United States Dept. of the Army, Quartermaster Corps, Chemicals & Plastics Division, Natick, Mass.

"Properties of Commercial Translucent Panels (Part II)" Ralph H. Sonneborn and Andrew L. Bastone, Owens-Corning Fiberglas Corp.

Authors' Panel Discussion.

Session III—Design, Part I

Presiding: George L. Lubin, Grumman Aircraft Engineering Corp.
Vice Chairman: Elliott N. Dorman, Ciba Products Corp.

"The Use of Reinforced Plastics in Submarine Superstructures and Fairwaters," Donald O. Buer, Mare Island Naval Shipyard, Vallejo, Calif.

"A Study of the Structural Properties of Reinforced Plastics as Applied to Underwater Weapons," Harlan J. Murray and D. Veronda, U. S. Naval Ordnance Test Station, Pasadena Annex, Calif.

"Design Data for Circular Reinforced Plastic Plates," Rolf L. Thorkildsen, Materials and Processes Laboratory, General Electric Co.

"Design of Reinforced Plastics Structures," Lawrence Fischer, Grumman Aircraft Engineering Corp.

"Design of Filament Wound Structures," William R. McCarthy, Brunswick-Balke-Collender Company.

Authors' Panel Discussion.

12:30 to 2:00 P.M.—Luncheon.

Welcoming Address: George A. Stein, A. O. Smith Corp.

2:00 to 5:00 P.M.—Concurrent sessions on High Temperature and Environment—Part I; Plastics for Tooling; and Design, Part II.

Session I—High Temperature and Environment, Part I

Presiding: George L. Rudkin Jr., Atlas Powder Co.
Vice Chairman: J. N. Butler, Monsanto Chemical Co.

"Performance Characteristics of Unsaturated Polyesters of Hydrogenated Bisphenol A," R. A. Cass and E. T. Reaville, Monsanto Chemical Co.

"A Comparative Study of Corrosion Resistance of a Bisphenol Resin, an Isophthalic Resin, and a General-Purpose Polyester Resin," S. S. Feuer and A. F. Torres, Atlas Powder Co.

"Deterioration of Epoxy Laminates Under Extreme Aging Conditions," N. C. W. Judd, T. Lloyd, P. McMullen, and E. W. Russell, Chemistry Department of the Royal Aircraft Establishment, England.

"Glass Reinforced Plastic Laminates in Contact with Fuels or Sea Water," J. B. Alfers and W. R. Graner, Bureau of Ships, Dept. of the Navy.

"Adhesion and Surface Prepa-

ration," John E. Rutzler Jr., Case Institute of Technology.
Authors' Panel Discussion.

Session II—Plastics for Tooling

Presiding: Elliott N. Dorman, Ciba Products Corp.
Vice Chairman: Fred Lyijynen, Chrysler Corp.

"Plastics Materials Most Suitable for Tooling and Organizing to Use Them—Successfully," N. K. Hankins, Rezolin Inc.

"Foundry Applications," Thomas S. Johnston, Weil-McLain Co.

"Epoxy Plastics for Tooling Investigations," Prof. O. D. Lascoe, Purdue University, Dept. of Industrial Engineering.

"A User Looks at Plastic Tooling," Lee L. Linzell, Chrysler Corp., Stamping Division.

"A Rebuttal: A Vendor Looks at Plastics Tooling," William R. Weaver, Modern Pattern & Plastics Inc.

Authors' Panel Discussion.

"Plastic Planking for Master Models," H. L. Thomas, J. L. Hanson, and H. E. Renaud, Ren Plastics Inc., and J. W. Guyer, Conap Inc.

"Low Density Plastic Pattern Boards," B. J. Bryan, Furane Plastics Inc.

"Reinforcing Material for Plastics," Lewis F. Bogart, Detroit Representative, The Marblette Corp.

Session III—Design, Part II

Presiding: Dr. Harry R. Nara, Case Institute of Technology.
Vice Chairman: T. J. Jordan, General Electric Co.

"The Foam Weldment of Radome Panels," M. M. Hannoosh and S. C. Nilo, Massachusetts Institute of Technology, Lincoln Laboratory.

"Mechanical Design of 68-ft. Diameter Rigid Foam Radome," L. P. Farnsworth and T. F. King, Massachusetts Institute of Technology, Lincoln Laboratory.

"Development of Reinforced Plastics to Withstand Extreme Rough-Handling Tests," Thomas Harris and Robert Gelin, Structural Fibers Inc., and E. G. Bobalek, Case Institute of Technology.

"The Effect of Combining Reinforcement on Laminate Strength in Boats," L. D. Moore and Peter P. Lahde, Ferro Corp., Fiber Glass Div.

"Abrasion and Wear Resistance Characteristics of Reinforced Polyester Surfaces," C. B. Sias, Pittsburgh Plate Glass Co.

Authors' Panel Discussion.

Wednesday, February 3

9:00 A. M. to 12:00 Noon—Concurrent sessions on Processing; Transportation—Land, Air, Sea, and Space; and Research.

Session I—Processing

Presiding: A. W. Levenhagen, Molded Fiber Glass Tray Co.
Vice Chairman: Arthur J. Wiltshire, Apex Reinforced Plastics Division of the White Sewing Machine Co.

"Preimpregnated Fabric as a Raw Material for Reinforced Plastics," Henry M. Toellner, Fabricon Products, a Div. of Eagle-Picher Co.

"Infra-red (Radiant) Heat for Processing Plastics," Paul H. Krupp, The Fostoria Pressed Steel Corp.

"The Effect of Molding Conditions on the Color of Reinforced Plastics Moldings," T. H. Beals, Pittsburgh Plate Glass Co.

"Centrifugal Molding," Arthur J. Wiltshire, Apex Reinforced Plastics Div., White Sewing Machine Co.

"In-Plant Resin Testing," Arthur Weber, Interchemical Corp., and Bruce Martin, Molded Fiber Glass Tray Co.

Authors' Panel Discussion:

Session II—Transportation: Land, Air, Sea, and Space

Presiding: John F. Reeves, Litewate Engineering
Vice Chairman: Harriet E. Raymond, Celanese Corp. of America

"A Role for Reinforced Plastics in the Cryogenic Transportation Field," Kenneth C. Sanders, The Heil Co.

"Reinforced Plastics Trailers," W. S. Eubanks, Eubanks Industries Inc.

"Why Reinforced Plastics for Transportation Vehicles," R. C. Kennedy, GMC Truck and Coach Div., General Motors Corp.

"Plastic Sandwich Panels in the Transportation Field," Phillip H. Stiles, Perfection Industries, Div. of Hupp Corp.

"Reinforced Plastic Motor Truck Cabs," Robert L. Wiese, Molded Fiber Glass Body Co.

"Reinforced Plastic Lifeboats," John A. MacInnes, Maritime Adm., U.S. Dept. of Commerce.

Authors' Panel Discussion:

Session III—Research

Presiding: Frederick J. McGarry, Massachusetts Institute of Tech.
Vice Chairman: Harry R. Nara, Case Institute of Technology

"Ultraviolet Degradation of Polyester Resins and the Use of Protective Ultraviolet Absorbers," R. C. Hirt, R. G. Schmitt, and N. D. Searle, American Cyanamid.

"Long Term Durability of Acrylic Modified Polyester Resins vs. 100% Acrylic Resins in Glass Reinforced Constructions," Arthur L. Smith and John R. Lowry, Rohm & Haas Co.

"Study of Interface Relationships in Glass Reinforced Plastics Systems by Sorption Methods," Kurt Gutfreund and H. S. Weber, Armour Research Foundation, and Callaway Brown, Whirlpool Corp.

"The Role of Silane Coupling Agents in Glass Reinforced Plastics," B. M. Vanderbilt and J. P. Simko Jr., Esso Research and Engineering Co.

"Use of the Differential Expansion Technique for the Study of Internal Strain in Reinforced Plastics Structures," J. G. Mohr, Johns-Manville Fiber Glass Inc.

"The Use of Fluorescent Tracers to Show the Internal Cracks in Reinforced Laminates That Are Inherent in Their Construction," John O. Outwater, The University of Vermont.

Authors' Panel Discussion.

12:30 to 2:00 P.M.—Luncheon.
Presiding: Clare E. Bacon, Owens-Corning Fiberglas Corp
Principal Topic: *"The Reinforced Plastic Cultural Pavilion for the American National Exhibition in Moscow,"* George Nelson, George Nelson & Co. Inc.; A. G. H. Dietz, M.I.T.; and James S. Lunn, Lunn Laminates Inc.

7:00 P. M.—Annual Banquet.
Toastmaster: A. W. Levenhagen, Molded Fiber Glass Tray Co. and

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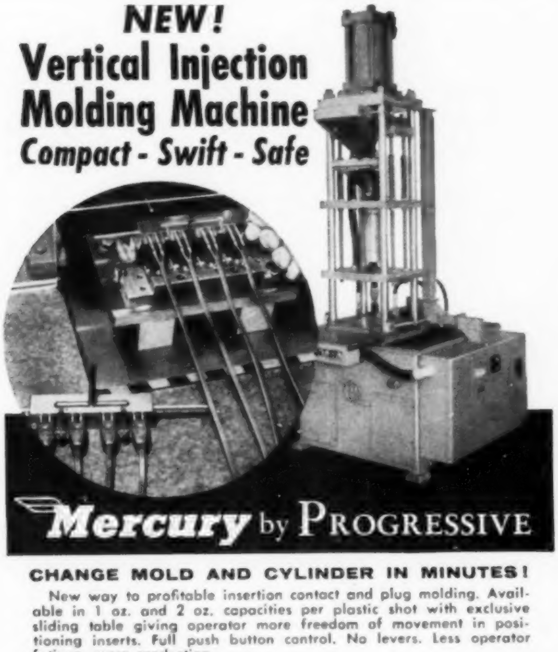

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  Melt temperatures up to 750°F
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General Chairman of the S.P.I. Reinforced Plastics Div.
Executive Committee Awards.

Thursday, February 4

9:00 A.M. to 12:00 Noon—Concurrent sessions on Mechanical Behavior; Consumer Products, Part II; and Materials.

Session I—Mechanical Behavior

Presiding: L. S. Lazar, General Electric Co.

Vice Chairman: George L. Lubin, The Grumman Aircraft Engineering Corp.

"Design of Mechanical Joints for Reinforced Plastics Structures," Eric L. Strauss, The Martin Co.

"Modulus—Deflection Relationship for Glass Reinforced Laminates," R. Hunter Calderwood, Westinghouse Electric Corp.

"Stress Response of Glass-Filled Resins Above Their Glass Transition Temperatures," D. L. Hollinger and C. D. Doyle, General Electric Co.

"On Relating Ultrasonic Scanning Information to Size, Shape, and Type of Flaws in Laminated Plastics Structures," T. J. Griffen, G. S. Binns Jr., C. D. Doyle, and V. C. Petrillo, General Electric Co.

"Design of Reinforced Plastic Compositions for Impact Strength," Edward G. Bobalek and Robert M. Evans, Case Institute of Technology.

Authors' Panel Discussion.

Session II—Consumer Products, Part I

Presiding: Harry R. Cote, Allied Chemical Corp.

Vice Chairman: Alvaro Salgado, Reichhold Chemicals Inc.

"Surface Quality of Fiberglass Reinforced Polyester Moldings," W. J. Diamond, The Brunswick-Balke-Collender Co.

"Plastic Armored Joints on Concrete Pipe, City of Los Angeles—Hyperion Outfall Project," Lloyd J. Oye, Rezolin Inc.

"An Investigation of Some Variables Encountered in the Polyester Hand Lay-Up Field," E. S. Mylis, Plastics and Coal Chemicals Div., Allied Chemical Corp.

"Evaluation and Development

of Glass Reinforced Plastic Pipe for the Petroleum Industry," R. M. Levy and B. M. Vanderbilt, Esso Research & Engineering Co.

"Reinforced Plastics in the Chemical Industry," James J. Fischer, American Cyanamid Co.

Authors' Panel Discussion.

Session II—Materials

Presiding: T. J. Jordon, G-E.
Vice Chairman: L. Stievater Jr., McKesson & Robbins Inc.

"Thermal Aging of Fused Silica Yarn," H. T. Plant and R. T. Girard, General Electric Co.

"Preparation and Properties of Reinforced Laminates Made at Contact Pressures from 100% Silicone Resins," D. T. Retford, M. E. Nelson, and K. R. Hoffman, Dow Corning Corp.

"X-Crepe Paper as Reinforcing Material," V. E. Calvin, Cincinnati Industries Inc.

"Polyester Polymerization with Mixed Catalysts Systems," James B. Harrison, Orville L. Mageli, and Suzanne D. Stengel, Lucidol Div., Wallace & Tiernan Inc.

Authors' Panel Discussion.

12:30 to 2:00 P.M.—Luncheon
Presiding: A. W. Levenhagen, Molded Fiber Glass Tray Co.

2:30 to 5:30 P.M.—Concurrent sessions on Electrical; Spray-Up; and High Temperature and Environment, Part II.

Session I—Electrical

Presiding: D. V. Rosato, Raytheon Manufacturing Co.
Vice Chairman: Roger B. White, The Glastic Corp.

"New Copper Clad Reinforced Laminates for Electrical Use," Francis H. Bratton and Fred U. Zolg, The Cincinnati Milling Machine Co.

"Dielectric Properties of Reinforced Plastic Honeycomb," G. P. Wetterborg and Moe Kazimi, Hexcel Products Inc.

"Technical Capabilities and Development in Electrical Engineered Missile Units," Ralph C. Pratt and Gim P. Fong, Raytheon Co., Plastic Plant, Research Div.

"Temperature Cycling of Laminates Applicable to High Temperature Aircraft Radomes," B. G. Kimmel, J. S. Schiavo and G. D. Robertson, Hughes Aircraft Co.

"The New Look in Glass-Polyester Premixes," Roger S. Jackson, The Glastic Corp.

Authors' Panel Discussion.

Session II—Spray-Up

Presiding: Robert J. Brinkema, Firmaline Products Inc.

Vice Chairman: T. B. Blevins, Department of the Army, Office of the Chief of Ordnance, Washington, D.C.

"An Air Force Approach to Rigid Reinforced Plastics Shelters," Anthony F. Gurdo, Joseph M. Schramp, George J. Stabler, and John E. McCormick, Rome Air Development Center, Griffiss Air Force Base, N. Y.

"Spray Molding of Reinforced Plastics," Marvin E. Carr, Fiberlay, Inc.

"Rand Fiber Resin Depositor," Nicholas Binder and D. Eldred, Rand Development Corp.

"Large Epoxy Reinforced Plastic Structures," A. G. Butler and A. W. Hawkins, Union Carbide Plastics Co., Div. of Union Carbide Corp.

"Field Contracting Uses of Sprayed Fiberglass and What the Future Holds for It," David H. Richman, Spray-Bilt Inc.

Authors' Panel Discussion.

Session III—High Temperature and Environment, Part II

Presiding: J. N. Butler, Monsanto Chemical Co.

Vice Chairman: S. S. Feuer, Atlas Powder Co.

"Creep of Thermoplastic Materials as Affected by Applied Electrical Field and Load," Selby M. Skinner, Joseph Gaynor, and Edward L. Kern, Case Institute of Technology.

"The Effect of High Vacuum and Ultraviolet Radiation on Reinforced Plastics," Norman E. Wahl, Cornell Aeronautical Laboratory Inc.

"The Effect of Long Time, High Temperature Aging on the Physical and Electrical Properties of Silicone Laminates," E. C. Elliott and K. R. Hoffman, Dow Corning Corp.

"Plastics for High Temperature Thermal Barriers," M. Goldstein and Henry T. Plant, General Electric Co.

Author's Panel.—**End**

NEW DEVELOPMENTS

Many minds at work on new ways to use plastics, new designs, and new product concepts offer ideas you can use.

VACUUM FORMED butyrate display in pendant design contains aluminum foil that reflects interior colored lights; retails at $59.75.

Thermoformed holiday displays

Large holiday displays, filled with aluminum foil that reflects interior colored lights, are vacuum formed from extruded butyrate sheet.

The two-faced displays are manufactured by General Plastics Corp., Marion, Ind. They include a 30-in., 8-lb. teardrop design, a 36-in., 10-lb. pendant, and a 40-in., 10-lb. cone. The latter is completely transparent, while the others have painted designs in addition to the transparent reflecting areas.

The two halves of the display are screwed together at the outer edges, and reinforced within by an aluminum framework. An interior skeleton of nylon cord holds the aluminum foil in place.

Both cone and pendant retail for $59.75, and the teardrop costs $45. Butyrate material for sheet extrusion is supplied by Eastman Chemical Products Inc., Kingsport, Tenn.

Stays that stay

Another plastic material has entered the garment field in the form of stays for men's shirt collars, as well as for brassieres, foundation garments, and bathing suits. Fabricated of folded Mylar (Du Pont) polyester film, the new stays can be permanently sewn in place without affecting strength and stiffness, and will easily withstand laundering.

The Mylar stays, according to the manufacturer, Endsdown Co. Inc., New York, N. Y., combine adequate and controllable rigidity with a resilience that ensures wearer comfort. In addition, a company spokesman says that "these stays offer real savings in (garment manufacturing) labor costs. Not only can they be sewn in place easily but also they eliminate some of the fine finishing steps necessary when steel is used. For example, bindings can be sewn on directly through the stay," the spokesman added.

Fabrication of the Mylar stays is by a folding process rather than laminating or using a single thickness of film. The folding results in greatly increased rigidity, which is controllable by varying the thickness of the film used or, more importantly, by the degree of pressure applied in the folding process.

Already well established in the field of permanent garment stays is a fibrous extrusion of a cellulosic-based material (MPl, June 1952, p. 173) which also can be sewn in place. This material, known as Bonar, is produced by Anchor Plastics Co. Inc., Long Island City, N. Y.

Dual-purpose cushions

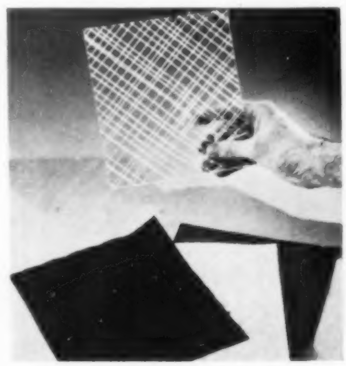
Combination of comfort and safety is provided by newly-developed boat cushions that can be snapped together to form an emergency raft. The buoyancy is provided by Ensolite cushioning material, a self-extinguishing vinyl sponge developed by U. S. Rubber Co.

The cushions are designed for cockpit seats and are custom-designed by Charles Ulmer, Inc., City Island, N. Y. They have simple ring and snap hardware which is concealed when the cushions are in place on the boat, and can be fitted together rapidly to form a raft. Grasping hand-holds on the side are an additional life-saving feature.

Reinforced film

Improved tear resistance is imparted to plastics film and sheeting through the incorporation of non-woven reinforcing grids of Dacron or nylon.

Polyethylene, PVC, and polyester films so reinforced are now manufactured by the Griffolyn Co. Inc., Madison, Wis. According to the company, the new films are less expensive than films having inherently the same tensile strength (without re-



inforcement). Prices range from 16½¢/ft. for 5-mil, nylon-reinforced polyethylene film, to 61¢/ft. for 12-mil, Dacron-reinforced PVC sheeting. Tensile strengths, measured diagonally to the web, are said to range on the average from 55 to 120 p.s.i. for these materials.

The reinforcing fibers are allowed to move freely and gather up at points where stress is applied. Dacron and nylon fibers are specified, rather than glass fibers, are said not to cut polyethylene film and to have better flex qualities.

The fabric-film materials, 18 in number, are sold in rolls approximately 300 ft. long and 50 in. wide in gage from 2½ to 14 mils. Several colors as well as clear are available in polyvinyl chloride film, clear only in polyester films, and either clear, black, (To page 190)

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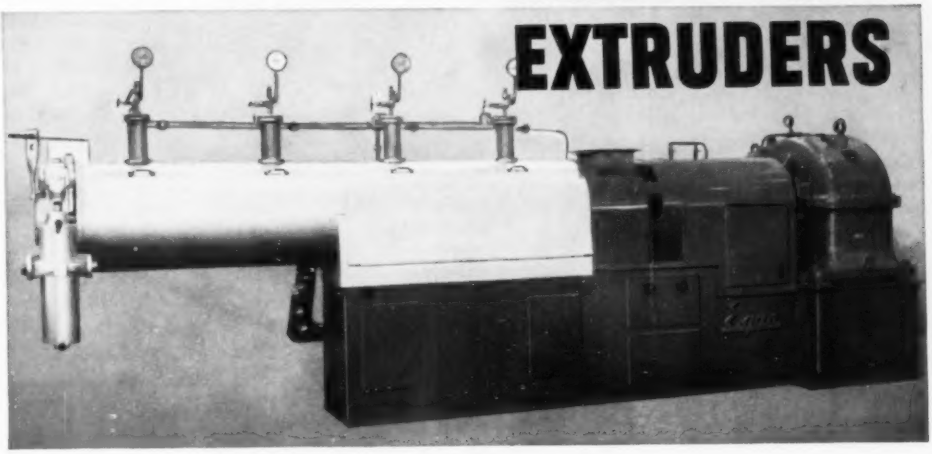

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(From page 188)

or white in the polyethylene types. Among the many suggested applications are: tents and weather shelters; balloons; tarpaulins; air houses and greenhouses; tank liners; swimming pool covers; ditch liners; decorative materials; and bags and sacks.

Formed model kit

Two model airplane kits from Babcock Models Inc., Costa Mesa, Calif. are based on parts thermoformed from impact styrene sheet, a new concept in model construction. The components, consisting of the fuselage, wings, tail and numerous auxiliary parts, are vacuum formed from Campco S-540 sheet stock supplied by Campco Div., Chicago Molded Products Corp., Chicago, Ill. in 17½- by 44-in. dimensions, with thickness depending upon the required use of the piece.

The manufacturer specified 0.010-in. material for stabilizers. 0.020-in. for wings, 0.030-in. for fuselage pieces, and 0.040-in. for cowling and several other parts.

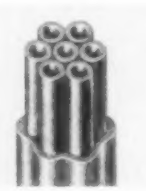
From four to nine components per sheet are formed in one operation on a machine of Babcock's own design, then die cut on a 50-ton automatic punch press. The complete operation involves eight forming dies and seven cutting dies. Colors are silk screened on the sheet stock before the forming operation.

The Piper model has a 37-in. wingspan, while the Aeronca features a 39-in. wingspan. Both models retail for $9.95, and are adaptable to free flight and control line, as well as radio control flying.

Tube packs for automation

Bundles of small-diameter polyethylene air pressure tubes encased in a vinyl sheath have been developed for specific use as air carriers in automated plants.

These tubes are used to carry air pressure from control panels through meters and gages to valves and other operating devices. Because of the tube pack's chemical resistance, it has found a major outlet in chemical processing plants and refineries, as well as numerous other industries where severe corrosive conditions are found.



CUTAWAY view of tube pack consisting of seven inner polyethylene tubes encased in a vinyl outer jacket.

Designed and extruded by Pyramid Plastics, Inc., Chicago, Ill. the tubing will replace metal tubes as well as single plastic tubes. According to Pyramid, every manufacturer who has installed this system reports large cost savings; however, installation set-up varies so much from plant to plant that no exact figures are available.

The jacket is extruded from an abrasion-resistant Geon vinyl compound supplied by B. F. Goodrich. It serves to protect the small inner tubes from damage, insures clean air lines and simplifies the installation of the multiple tube system. The inner tubes, which may vary in number from 2 to 37, can be extruded from various grades of polyethylene, depending upon the customer's requirements, and are color coded for quick identification of the individual air lines.

The product, called "Instrupack," is available with inside tubes of ¼-in. O.D. by 0.040-in. wall with a 0.045- or 0.062-in. sheath and inside tubes of ⅜-in. O.D. by 0.062-in. wall with a 0.045 or 0.061-in. sheath.

A typical price per 1000 ft. for the ¼-in. O.D. by 0.040-in. wall tubing with 0.045-in. sheath encasing, 7 tubes, range from $397 to $502, depending upon footage ordered.

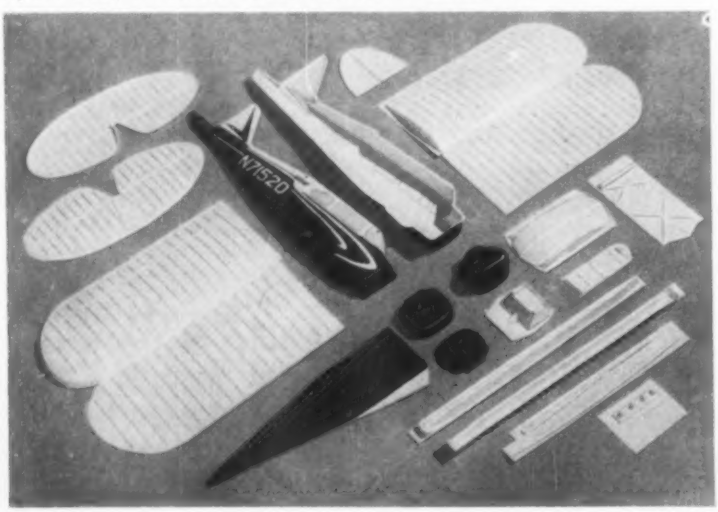
Supersonic canopy

With many of today's aircraft operating at beyond the speed of sound, plane canopies must exhibit high heat resistance, shatter resistance, and load carrying characteristics. To meet this demand, Goodyear Aircraft Corp., Akron, Ohio, has developed Thermo-Shield, a composite laminate consisting of two pre-formed outer layers and one inner layer. One outer layer is multi-axially stretched acrylic sheet, the other cast polyester, cast acrylic, or glass sheet. Between these layers is an interlayer, coded F-3 by Goodyear Aircraft Corp., which is, in essence, a moderately high-temperature flexible resin system.

In the laminated canopy, stretched acrylic, usually Plexiglas 55 (Rohm & Haas), is the inner, load-bearing ply. In its multi-axially stretched form, it has improved resistance to crack propagation and stress-solvent crazing. The outer layer, or thermal barrier, is composed either of glass sheet, polyester-base thermosetting materials (Sierracin 880 or 890, from Sierracin Corp.), or thermosetting acrylic cast sheeting (Selectron 400, from Pittsburgh Plate Glass Co.).

The fluid resin interlayer is said to be easily castable, and to cure to a tough flexible state at temperatures below 220° F. One disadvantage of former interlayers was the high temperatures required for curing, which were not compatible with the critical temperature of stretched acrylic sheet. The new interlayer is reported to provide good adhesion to polyester, acrylic, and glass materials, to be (To page 192)

PRE-FINISHED parts in plane kit are vacuum formed from impact styrene sheet, will be constructed into Piper Tri Pacer model.



highly craze-resistant, and is transparent in the cured state.

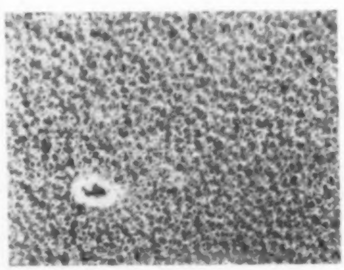
Canopies formed with the new interlayer are said by the manufacturer to have temperature limits of between 350 to 400° F. Lead nose bullets of .38 and .45 caliber fired at a distance of 50 ft., were reported by the company to have been unable to penetrate the outer thermal barrier material.

Washable filter

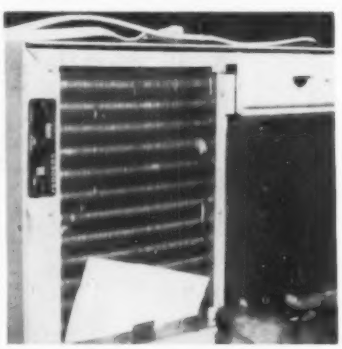
A special type of open cell urethane foam has been adopted as a filter material by Fedders Corp. for most of its 1960 line of room air-conditioners. When it becomes loaded with dirt, the filter may be washed in soapy water or detergent, wrung dry, and re-installed in the air-conditioning unit.

Because of this easy maintenance, the filter is more likely to be cleaned when necessary, contributing to the efficiency and longer life of the air-conditioner.

The foam, made by Scott Paper Co., differs from conventional urethane foam in that it does not contain the thin membranes which usually enclose the gas bubbles. The fully skeletal structure of the filter offers little resistance to air-flow, and permits airborne impurities to collect uniformly through the depth of the filter. The entire filter weighs slightly more than 1 oz., compared with 5½ oz. for the aluminum filter which it replaces.



Photos, Allied Chemical Corp.



URETHANE filter being installed in air-conditioning unit. Photo (at top) shows close-up of cell structure. Note grommet hole.

. . . And in brief

Insert-type fittings molded of Plaskon nylon in sizes up to 4 in. now available from Plastiline Inc., White Plains, N. Y.

Lunn Laminates Inc., Huntington Station, N. Y., is molding the cockpit for first commercial jet simulator for Link Aviation Inc., from glass-reinforced polyester. Simulator eliminates need for keeping operational craft inactive for training purposes.

Six-foot replica of its RP outboard motor is being molded for Outboard Marine by Mold-Craft Inc., Point Washington, Wis. Material used is a rigid plastisol formulated by A. P. Nonweiler Co., Oshkosh, Wis., from Goodrich Geon vinyl resin. The replica makes an impressive display.

Cast cross-linked styrene copolymer, supplied by Rex Corp., West Acton, Mass., is now used for radar feed horn housings north of the DEW line. Housing withstands cold, wind, snow, hail, birds, and flying objects. Integral channels permit circulation of warm air to prevent icing—cause of wave distortions.

Corrugated reinforced polyester paneling in roll form was used by Warner Machine Products Inc., Munice, Ind., as sidewall glazing throughout a newly built plant. The company makes automotive water pumps. The RP corrugations are produced by Fiber Glass Plastics Inc., Miami, Fla., in rolls up to 150 ft. and up to 51 in. wide, using Rohm & Haas Paraplex P-446B acrylic polyester. The material, trademarked Corostron, was supplied for this application to specifications by Fabricated Metal Products Co., Louisville, Ky.

A polyethylene coaster with a tear-off attachment can be hung around the neck of a soda or liquid bottle as an inexpensive promotion piece. The item is injection molded by Spir-It Inc., Malden, Mass., using A-C Polyethylene supplied by Semet Solvay Petrochemical Div., blended with conventional low molecular weight polyethylene.

Lightweight garden tools, made by Diamond Products Co., Los Angeles, Calif., have aluminum handles coated with Geon vinyl plastisol, supplied by Goodrich.—**End**

LITERATURE

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Chemical Analysis of Resin-Based Coating Materials," *Edited by C. P. A. Kappelmeier.*

Published in 1959 by Interscience Publishers, 250 Fifth Ave., New York 1, N. Y. 645 pages. Price: $19.50.

This book, "written by practitioners for practitioners," is intended to "be a practical work of reference" and to stimulate research on as-yet-unsolved analytical problems. Dr. Kappelmeier (who died on March 29, 1959) wrote about one-fourth of the book. The rest was done by a team of 25 experts from six Western countries. Beginning with an extremely detailed table of contents, the book goes on to 21 chapters covering all aspects of the analysis of oil-based coating materials, latex paints, and lacquers. 200 pages are then devoted to special topics such as identification of fatty acids, halogen compounds, silicones; analysis of polyester and isocyanate materials; determination of purity of compounds found in coatings. Almost nothing is said about epoxy-based coatings, and the analysis of coatings already applied and dried is not discussed. Analytical procedures are completely detailed, should be clear to anyone with moderate training in chemistry. Though the editor was a Hollander, his English (and that of the other contributors) is amazingly accurate and smooth. Referencing seems to have been selective rather than exhaustive; oddly, few dates are later than 1955. Author and subject indexes total 23 pages—*J.F.C.*

Testing and standardization. "International Symposium and Plastics Testing and Standardization—STP 247" discusses "How National Standards are Achieved," "Engineering Properties of Plastics," "Thermal Properties of Plastics," "Molecular Characterization, etc." 276 pages. Price to non-members: $6.00. A.S.T.M. Members: $4.80. *American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.*

Thermoforming. "Vacuum Forming Shapes New Markets; New Opportunities describes the techniques, history of the process, range of applications, and uses and similar data for Tenite butyrate, acetate, propionate, and polyethylene. 18 pages. *Eastman Chemical Products Inc., Kingsport, Tenn.*

Size reduction equipment. Specifications, uses, performance data, and other technical information on the torpedo mill and oscillating granulator, which are used to granulate, pulverize, mix, shred, pulp, chop, disperse, and recover plastics materials. Bulletin 350. 4 pages. *F. J. Stokes Corp., 5500 Tabor Rd., Philadelphia 20, Pa.*

Fabrication of Plexiglas. Describes design considerations, forming, cementing, machining, finishing, cleaning and maintenance, annealing, and sources of supply. 34 pages. *Commercial Plastics & Supply Corp., 630 Broadway, New York 12, N. Y.*

Instrumentation systems. Describes and illustrates services offered, from installation through start-up service for automation and instrumentation systems. Bulletin 107. 16 pages. *Panellit Service Corp., 7401 N. Hamlin Ave., Skokie, Ill.*

PVC materials. Basic technical information about the range of products manufactured by the company, including Breon vinyl resins, latices, and compounds, and nitrile rubbers and latices. Data Book 1. 16 pages. *British Geon Ltd., Devonshire House, Piccadilly, London W1, England.*

Polypropylene. "Moplen . . . Breakthrough in Polyolefins" discusses the history, markets, products, engineering and production facilities, etc., and properties of Moplen and its uses. 16 pages. Montecatini, Milan, Italy. U. S. representative: *Chemore Corp., 21 West St., New York 6, N. Y.*

Power control units. Specifications, uses, engineering data, etc., for five different power control units utilizing magnetic gating amplifiers driving silicon controlled rectifiers. Bulletin S-1075. 8 pages. *Magnetic Amplifiers Inc., 632 Tinton Ave., New York 55, N. Y.*

PVC resins for calendering. Properties, uses, etc., for Marvinol VR-31, a high molecular weight straight PVC resin for calendering operations where a dry blend is needed; Marvinol VR-33, medium-molecular-weight straight PVC resin for calendering of film, sheeting, and coated fabrics; and Marvinol VR-34, a medium-low molecular weight straight PVC, which has same applications as VR-33. Three bulletins of 1 page each. *Naugatuck Chemical Div., United States Rubber Co., Naugatuck, Conn.*

Injection molding. "Tom Swiftly and His Timed Machines" is a fiction-like presentation on the value of upgrading an injection molding plant. 4 pages. *Lester-Phoenix Inc., Dept. N-23, 2711 Church Ave., Cleveland 13, Ohio.*

Lab ware. Catalog describes a line of plastic laboratory apparatus, including sizes, prices, and other data. Catalog H459. 24 pages. *Rascher & Betzold Inc., 730 N. Franklin St., Chicago 10, Ill.*

Automatic weighing systems. "Weight of Bulk Materials" describes the automatic measurement and control of bulk materials through unitized weighing systems of pre-engineered components. Catalog 14. 24 pages. *Weighing & Control Components Inc., 848 E. County Line Rd., Hatboro, Pa.*

Steel rule dies. Describes the facilities and services available for making steel rule dies and special shapes used in die-cutting formed pieces, and other applications. 4 pages. *Acme Steel Rule Die Corp., P. O. Box 6714, Waterbury, Conn.*

Metering, mixing equipment. Features, specifications, uses, etc., for the Model SP1558 automatic "shot" meter-mixer for two-part compounds and adhesives. 4 pages. Similar data is presented for the 1600 Series automatic metering, mixing, and dispensing equipment for two-part compounds. 6 pages. *Pyles Industries Inc., 20855 Telegraph Rd., Detroit 41, Mich.*

Basic Guide to Ferrous Metallurgy. Of particular interest to mold makers, this 4-color chart gives the principal characteristics of steels across the temperature range to 2900° F., includes the important working zones—preheating for welding, stress relieving, normalizing, annealing,

carburizing, and forging—and defines 24 common metallurgical terms. 2 pages. *Tempil Corp. 132 W. 22nd St., New York 11, N. Y.*

Vinyl-metal laminate. Technical data, patterns, applications, architectural specifications, etc., for the Arvinyl line of vinyl-metal laminate wall materials. 8 pages. *Arvin Industries Inc., Columbus, Ind.*

Coating resins. Describes general characteristics of Miccron resins, which are used in a variety of coating applications. Includes information on the flocing, flame spraying, and fluidized-bed coating processes. Cellulosics, polyesters, nylons, vinyls, and epoxies are covered. 6 pages. *Michigan Chrome & Chemical Co., 8615 Grinnell Ave., Detroit 13, Mich.*

Acrylonitrile - butadiene - styrene. "Engineering and Molding Data on Kralastic MM, a New, Low-cost ABS Plastic with Excellent Physical, Chemical, and Electrical Properties for Injection Molding Vacuum Forming, and Extrusion." 12 pages. Bulletin 3. *Naugatuck Chemical Div., United States Rubber Co., Naugatuck, Conn.*

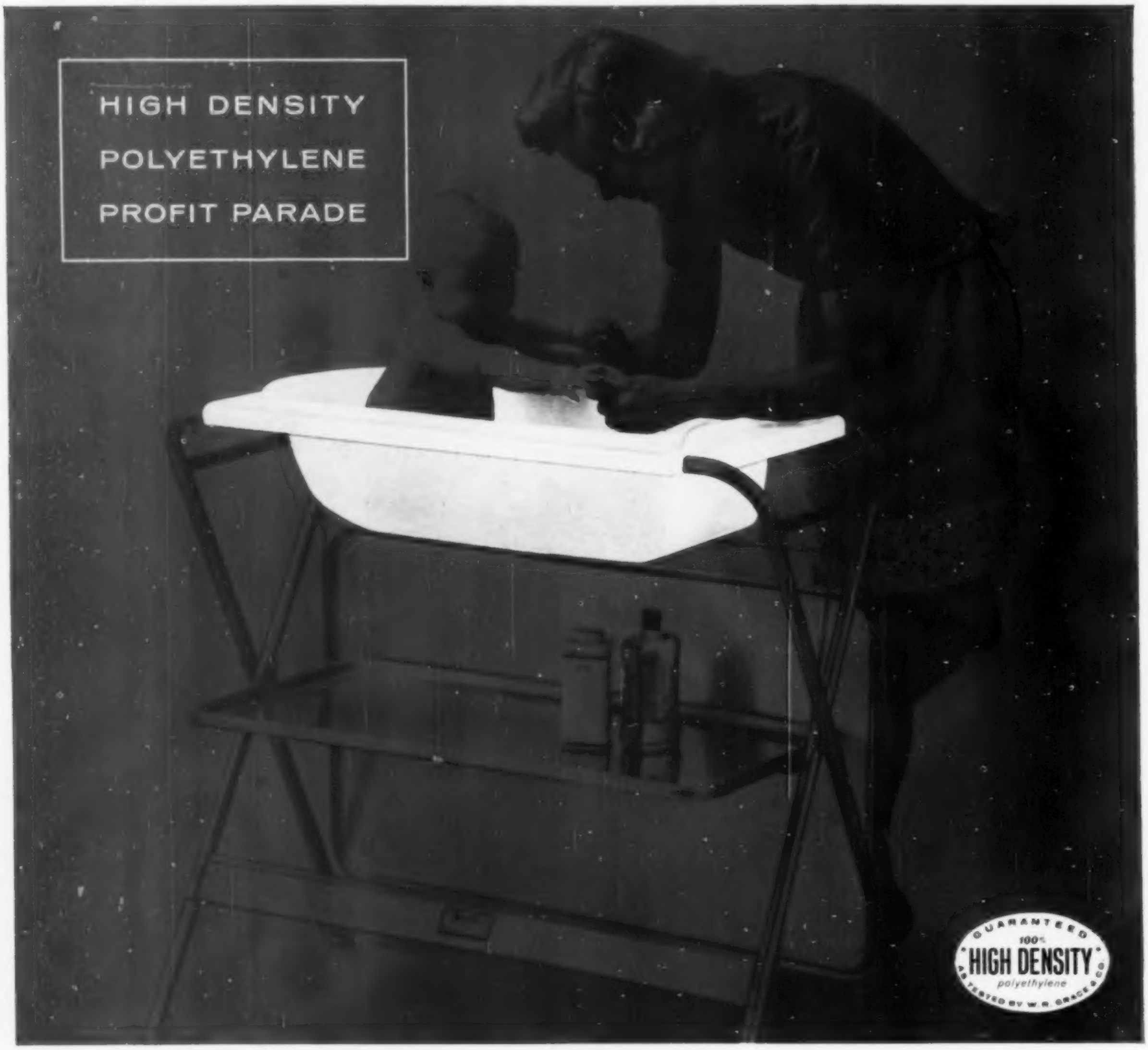
Protective coatings. Advantages, typical uses, etc., for a line of Del acrylic, epoxy, vinyl, alkyd, and other plastics-based coatings. 16 pages. *David E. Long Corp., 220 E. 42nd St., New York 17, N. Y.*

Polyester filter plates. Case history on how Thermaflow 100, a reinforced polyester molding compound, has replaced metal in making pressure-filter plates. 4 pages. *Chemicals Division, Atlas Powder Co., Wilmington 99, Del.*

Plant layout models. Catalog describes how this company's plastics scale planning equipment can be used in upgrading or designing a plant or office. 5000 machine tool models, plus information on 20,000 more, are available. 12 pages. *"Visual" Plant Layouts Inc., Pennsylvania Ave. at River, Oakmont, Allegheny County, Pa.*

Leak detector. Operating principles, features, application data, etc., for the M-60 mass spectrometer leak detector, which is of special interest to vacuum metallizers and formers. 12 pages. *Instrument Dept., General Electric, Lynn, Mass.*

Nylon potting forms. Describes line of nylon forms to serve as a mold to retain compounds used to pot electrical connectors **(To page 197)**



Exclusive Selling Advantages Offered in Lifetime Tub

Products in many different fields are gaining an edge over competition by utilizing the benefits of Grex high density polyethylene. The "Lifetime Tub" by Baby Bathinette Corporation is an example that really holds water.

This well-known manufacturer chose Grex to make a tub that would outlast competitive models since this is a tough plastic that is virtually indestructible. They used its molding characteristics to obtain a soft, pleasant, easy-to-clean texture. They took advantage of its strength and rigidity to make the tub light in weight for greater ease of carrying.

This new Grace plastic offers a unique combination of properties to help you create unique selling advantages. It takes a beating without chipping, cracking or breaking. It can be molded in any color and decorated. It resists the elements and most corrosive chemicals. And it is the only thermoplastic that takes boiling or freezing without losing its shape or strength.

If you need an idea of how to gain an edge over competition by using high density polyethylene be sure to call in the experts. Grace has the production facilities, technical service and experience to help put your product in the Grex profit parade. We're easy to do business with.

Grex is the trademark for W. R. Grace & Co.'s Polyolefins.

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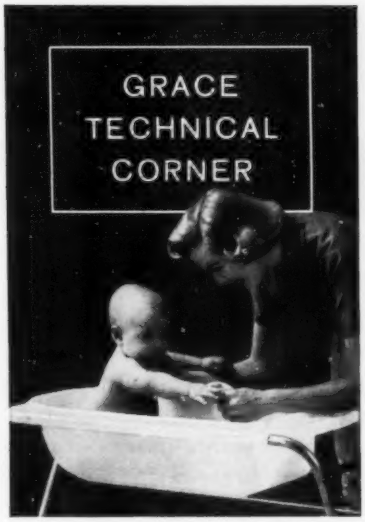
POLYMER CHEMICALS DIVISION CLIFTON, NEW JERSEY



Grex answers design and molding problems on extra-large piece.

Don't let size limit your thinking when designing or molding with Grex high density polyethylene. The "Lifetime Tub" shown here is 30½" x 6½" x 19"—one of the largest pieces so far injection molded with this Grace plastic. Some of the technical thinking that went into this job may give you an idea of how to get the most from Grex.

Cost a design factor. Production of a piece as large as this tub invariably presents a cost problem. Taking advantage of the way Grex performs in thin wall sections, the designers were able to keep the amount of resin per tub to a minimum and permit economical cycle times. Use of thin walls, however, called for a design that would not only take care of the weight of baby and water but also provide for satisfactory suspension of the tub in its metal frame. Reverse curves solved both problems and minimized use of ribs and fillets to avoid heavy sections, sinks and depressions.

Mold surface. Depending on mold surface, Grex takes any finish ranging from high gloss to matte. In this case, it provided a smooth, pleasant texture—essential to protect baby and make cleaning easy—through the use of a highly polished chrome-plated mold.

Molding technique. Production of the tub involved a 3-pound shot of Grex, a large mold cavity and thin wall sections. Under these conditions, multigating was chosen over normal gating. With four gates the cavity was filled faster and strain reduced.

What are your problems? If you have a job in mind for high density polyethylene count on Grace for help. Now's the time to call, wire or write:

Technical Service Department,
Polymer Chemicals Division,
W. R. Grace & Co., Clifton, N. J.

against the effects of moisture, oil, hydraulic fluid, fuel, salt spray, and fungus. *Electronic Production & Development Inc., 501 N. Prairie Ave., Hawthorne, Calif.*

Carbide burs. Presents a line of solid-carbide burs for use with power hand tools and flexible-shaft machines for cutting plastics and other materials. Catalog CB-59. 12 pages. *Thomas C. Wilson Inc., 21-11 44th Ave., Long Island City 1, N. Y.*

Plastics preheaters. Thermex dielectric equipment for plastics preheating, including specifications for load-handling capacity, heating rates, power input requirements, and dimensions of each model. 6 pages. *Girdler Process Equipment Div., Chemetron Corp., 334 E. Broadway, Louisville 1, Ky.*

Bronze powder finishes. Advantages, uses, samples, etc., for a line of "bronzeless gold" spray finishes for plastics and other materials. 8 pages. *Bee Chemical Co., Logo Div., 12933 S. Stony Island Ave., Chicago 33, Ill.*

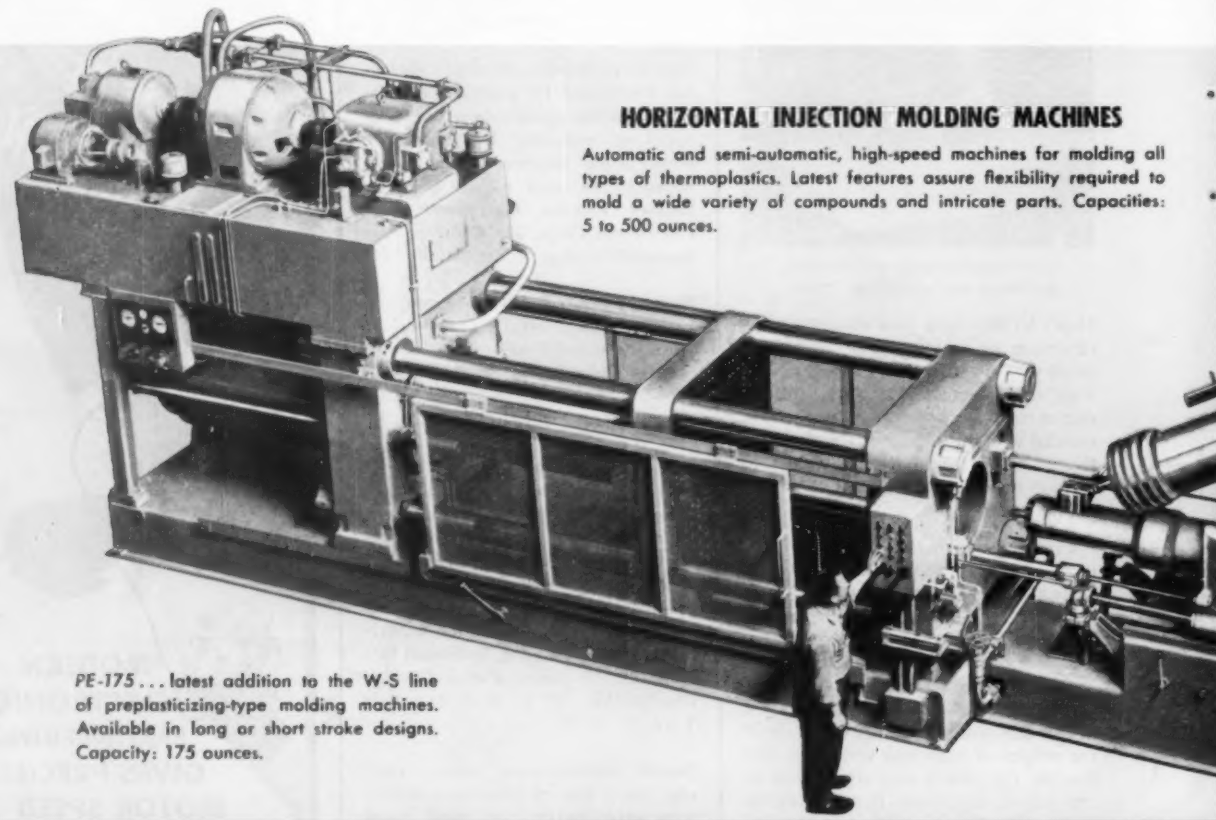
Chemical Resistance of Bakelite Phenolic Molding Materials gives the chemical resistance of seven compounds to acids, alkalies, solvents, and common mixtures. Data of special significance to fabricators contemplating use of phenolics in applications where corrosion is serious problem. Molding Technical Release 36. 12 pages. *Union Carbide Plastics Co., 30 E. 42nd St., New York 17, N. Y.*

Ovens. Specifications, prices, uses, etc., for a line of laboratory ovens, pilot plant ovens, and small batch type production ovens. c. 100 pages. *Despatch Oven Co., 619 S. E. 8th St., Minneapolis 14, Minn.*

Equipment price list. Description and price list for a line of vacuum metallizing equipment, vacuum components and systems, rotary gas ballast pumps, flexible connectors, low temperature baffles, gages and gage controls, vacuum melting and heat-treating furnaces, analytical equipment, coating equipment, etc. 16 pages. *NRC Equipment Corp., 160 Charlemont St., Newton Highlands 61, Mass.*

Tool steel for plastics molds. General properties, treatment instructions, quenching, tempering, and other technical data on a line of tool steel for plastics molds and other uses. 8 pages. *Uddeholm Co. of America Inc., 155 E. 44th St., New York 17, N. Y.*—**End**

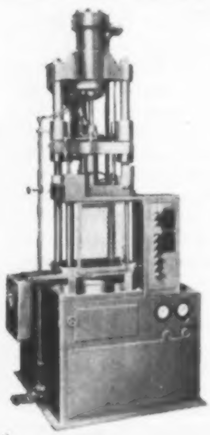
Watson-Stillman molding



HORIZONTAL INJECTION MOLDING MACHINES

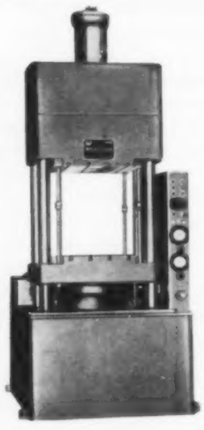
Automatic and semi-automatic, high-speed machines for molding all types of thermoplastics. Latest features assure flexibility required to mold a wide variety of compounds and intricate parts. Capacities: 5 to 500 ounces.

PE-175 ... latest addition to the W-S line of preplasticizing-type molding machines. Available in long or short stroke designs. Capacity: 175 ounces.



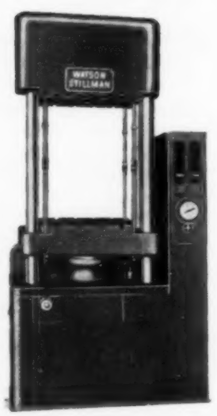
VERTICAL INJECTION MOLDING MACHINES

Designed to meet the need for low-cost high-speed production of small intricate moldings. Also well adapted to molding parts requiring inserts. Capacities: 1, 2, 6, 16, 20, 24 ounces.



TRANSFER MOLDING MACHINES

Standard four-column designs incorporating the latest features for molding thermosetting compounds. Ideal for small insert parts and cores. Adjustable opening to accommodate a variety of mold sizes. Capacities: 30 to 2000 tons.

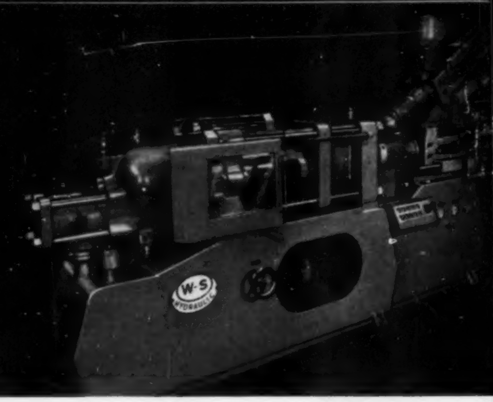


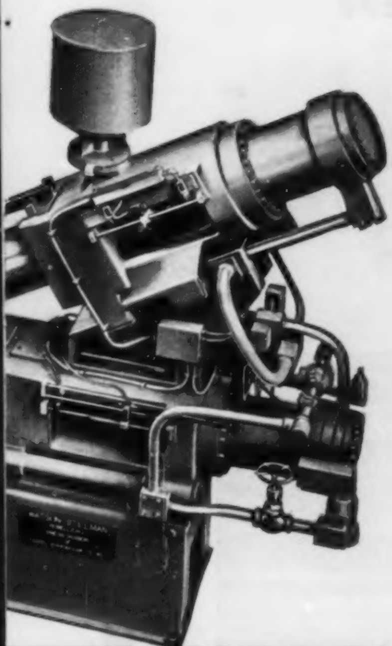
COMPRESSION MOLDING PRESSES

Can be converted to transfer press with transfer cylinder. Standard equipment includes bolsters, parallels, degassing, adjustable openings, top and bottom strippers, push-button control. Capacities: 50 to 2000 tons.

machinery

PE-15 . . . fully automatic, preplasticizing-type molding machine with 15-ounce capacity. Advantages: shorter cycles, better control of shot thickness and lower injection pressures.





Watson-Stillman is widely known for its "Completeline" of plastics molding machinery. From this line you can choose a model for virtually any molding requirement...a precision machine, built by specialists in molding equipment. Modern features of design assure high output at low cost.

Also available to "Completeline" users is Watson-Stillman's engineering counsel—a service which has grown out of the company's long association with every branch of the plastics industry. Whether your application requires a standard or special machine, Watson-Stillman engineers will be glad to help you discover the most economical solution.

Write for quotations, or complete details on any of the equipment shown.

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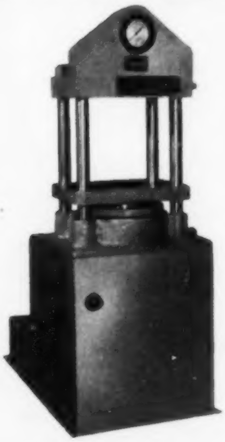
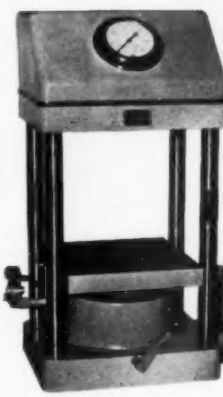


GENERAL-PURPOSE PRESSES

For molding and laboratory work, or for use as laminating press. Micro pressure adjustment makes them ideal for testing purposes. Automatic single-cycle control governs press dwell under pressure. Capacities: 30, 50, 100, 200 tons.



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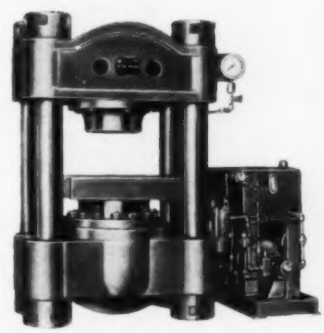
Designed for experimental work and wherever pressures of 30 to 100 tons are required on small areas. Ideal for die work, laminating and hot or cold molding. Capacities: 30, 50, 100 tons.



DIE-SINKING PRESSES

For producing dies that will meet the approval of the most exacting molder. Equipped with extra heavy platens, pumping unit, standard control valves, gauge, piping, anvil and inserts. Capacities: 200 to 3000 tons.

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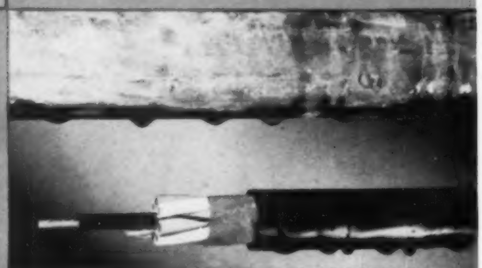
Harflex 330 features good electric properties, including high dielectric strength both dry and after immersion in water, plus rugged resistance to copper corrosion



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Harflex 330 imparts durability and permanent flexibility to vinyls despite their subjection to perspiration, oil, soil, frequent washing with soapy water or chlorinated solvents, humidity, heat and sunlight.

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EQUIPMENT • SUPPLIES • SERVICES

EPOXY CURING AGENTS. 10-page brochure discusses the characteristics and properties of two bifunctional alkyl alkanol amines. They undergo typical tertiary amine reactions and, in addition, contain hydroxyl groups which give them some characteristics of alcohol. Pennsalt Chemicals Corp. (L-901)

TAKE OFF. 4-page illustrated brochure describes a portable take off unit which accepts any shape plastic up to 5 in.; operates at speeds up to 238 ft. per min. H&T Machine Works. (L-902)

BLOW-MOLDING EQUIPMENT. Illustrated 4-page brochure lists specifications and describes components and operations of blow-molding machines with production capacities to 450 lbs. of material per hour. Auto-Blow Corp. (L-903)

VULCANIZED FIBRE. Illustrated 12-page brochure describes typical applications of the highly versatile Vulcanized Fibre, which has excellent arc resistance, low thermal conductivity, high abrasion resistance, and is exceptionally strong in relation to unit weight. National Vulcanized Fibre Co. (L-904)

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CAST ACRYLIC SHEET. Illustrated 4-page brochure describes a new type of precision cast acrylic sheet, offering closer thickness tolerance and a high degree of optical clarity and surface quality. Cast Optics Corp. (L-908)

GOLD FINISH. Illustrated 8-page booklet describes a finish for plastics, metals, glass and paper not based on bronze powder. Said to be cheaper, longer lasting and easier to handle and apply than bronze powder types. Color chips—Yellow Brass to Rich Copper and aluminum. Bee Chemical Co. (L-909)

RIGID VINYL SHEET. Illustrated 20-page booklet discusses and gives specifications and test data for a family of rigid vinyl compounds. B. F. Goodrich Chemical Co. (L-910)

TESTING EQUIPMENT. Illustrated 30-page catalog describes a line of physical testing machines for plastics featuring electronic loading, weighing and instrumentation. Tension, compression and flexure testing. Tinius Olsen Testing Machine Co. (L-911)

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INDUSTRIAL & SPECIALTY CHEMICALS. 6-page product index gives data on physical properties and shipping information on all in a line of industrial and specialty chemicals. Industrials are grouped under Acids & Anhydrides, Alcohols, Plasticizers, Aldehydes, Aromatic Intermediates, Solvents and Miscellaneous. Eastman Chemical Products, Inc. (L-914)

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CONTRACT THERMOFORMING. Illustrated 4-page brochure shows typical products and describes the services of this thermoformer and fabricator, who offers design and engineering services. Capable of forming very large pieces. Durable Formed Products, Inc. (L-937)

MARKING MACHINES. Illustrated 28-page catalog describes and gives specifications for a line of bench, treadle, pneumatic, pneumatic-hydraulic and hydraulic heavy-duty marking machines, marking type and holders, numerators and auxiliary equipment. Funditor, Ltd. (L-938)

VINYLPYRROLIDONE. 24-page booklet gives the physical and chemical properties of vinylpyrrolidone and discusses its reactions in copolymerizations. Tables and figures. Antara Chemicals Div., General Aniline & Film Corp. (L-939)

PLASTISOL COATING. Series of technical bulletins gives general specifications for a plastisol coating as used in such applications as coating plating racks, steel, bottles, gloves and rope and wire, and in slush molding, cold dip or spray and rotational casting. Reynolds Chemical Products Co. (L-940)

INJECTION MACHINE. Illustrated 8-page brochure describes a 2-oz. capacity injection molding machine with plasticizing capacity of 30 lbs. per hour, molding area of 12 x 8½ in. and maximum hydraulic pressure of 1000 psi. F. J. Stokes Corp. (L-941)

WIRE-DIAMETER CONTROL. 4-page brochure discusses the value of automatic diameter control in the production of insulated electric wire and cable, and compares the continuous-contact and non-contact methods in capability, limitation and cost. Daystrom-Weston. (L-942)

CUSTOM MOLDING. Illustrated 12-page brochure describes the facilities and services of a custom plastics molder. Injection molding, vacuum forming, die forming, imprinting, laminating, embossing, etc. Emeloid Co. (L-943)

CUSTOM EXTRUDING. Illustrated 4-page brochure describes the company's extrusion facilities and equipment. Extruders range in size from 2½ through 6 in. Services include fabrication, and tool and die facilities. Yardley Plastics Co. (L-944)

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The specialty phenolics

(From pp. 81-84)

ties. And the cost? Thirty-two cents per pound.

In missile work, new phenolic compounds with glass and quartz fillers are called upon to withstand even higher temperatures for shorter periods of time. Used in nose cones and as rocket motor insulation, the phenolic protects internal metal components against surface temperatures of 5000° F. At this temperature, at a gas velocity of Mach 3, although the special materials will have their surfaces scorched and eroded to a depth of about ⅛ in., they maintain their structural integrity in ½ in. sections. For contrast, a ½ in. thick phenolic-asbestos insulation is destroyed under these conditions. Although these materials cost $10.50/lb. they are cheap relative to what a slow-up in the missile program would cost.

All of these examples demonstrate the versatility of phenolics as first class engineering materials. These are all tough jobs where phenolics are often the only materials that do the job.

Being generally available in only blacks or browns, purely phenolic molding materials have been somewhat limited in the past to non-decorative applications. Although technology has not as yet been able to improve the colorability of phenolic resin itself, special blends of melamine and phenolic resins are now available in several stable and attractive colors at 34 to 45¢ per pound. In addition, new techniques have been developed to get around the color block to use the inexpensive phenolic molding powders in those specific decorative applications where other good properties are, likewise, required.

One of these techniques, which has been extensively used in the past on radio cabinets is painting and coating. Today there are decorative epoxy-based coatings and paints available which have excellent adhesion, abrasion resistance, and hiding power, and can be had in a variety of colors. Admittedly, decorative treatments increase the cost; however, when such properties as rigidity, dimensional stability, or heat re-

sistance are required the use of a coated phenolic is often the least expensive method. A good example of this is automotive dome light of one of our lower priced cars. Here vacuum metalizing applied a high chrome finish to the phenolic molding with striking results (photo, p. 84).

Another technique, not widely used today, may be electroplating. Using conductive phenolics which are currently available, it is possible to apply metal coatings and jackets up to several mils thick.

Another method for decorating phenolics is the use of melamine overlays. Although long used in the production of decorative laminates, it has not been widely exploited in molded parts. This method is at present limited to plain surfaces but could be used to advantage in parts with flat surfaces requiring a decorative treatment. In fact some work is going on to produce molded phenolic wall tile using this method and a specially formulated water resistant phenolic molding material has been developed.

People in the industry are talking about more and more integration in the design of phenolic parts. For instance, why not mold a printed circuit board with circuitry, mounting lugs, tube or transistor bases — all as one integral molding? It could result in lower tool costs and a reduction in the assembly labor required.

Today, with the advanced technology existing in the formulation and use of phenolic, the designer has at his command a greater and more versatile array than at any other time in the past. And if his requirements cannot be met with existing formulations, the resin supplier can reasonably be expected to solve his problems by developing new materials.

Acknowledgments

The editors are indebted to the technical and executive personnel of the Durez Plastics Div., Hooker Chemical Corp.; the Chemical Materials Dept. of General Electric Co.; Plastics Engineering Co.; Rogers Corp.; and Fiberite Corp. who have generously contributed their time and effort in supplying background materials for this article.—**End**

Do-it-yourself zoo

(*From pp. 94-95*)

duction run. In order to reduce pilferage at the dealer, the parts are polyethylene-film bagged at the machine as the first step in the packing operation.

What problems had to be solved

First test shots indicated a fill problem, due to both heavy and thin sections parts in the same mold. This problem was overcome by increasing the size of the runners. The runners on the three-color mold are 5/32 and 3/16 in., the runners on the conventional mold are 5/16 inch. The cycle for both molds is between 100 and 125 shots per hour.

There were shrink problems. Core pin dimensions (match pins) varied with each part because of differences in configuration. A rigid inspection system was set to determine the total shrinkage after molding. Matching and fitting the parts together according to the dimensions proved to be unsatisfactory due to shrinkage. This problem was finally solved by having final match lines between parts that had to mate machined by an engraver while the mold was in the injection machine on cycle.

Although the finished product seems to appear as if the parts were post-treated, the soft effect was achieved by extra care in the finishing of the mold steel.

The problem of the adherence of paint for the eye decoration of the animals was easily solved by using a ketone thinner with the lacquer base.

Much more difficult to solve than the mechanical production of the animals was the design concept of the original hand sculptured models. Each animal had to have certain personality characteristics of its own—and yet the parts of each one had to be interchangeable.

No sales or resin consumption figures are available on this application. But from all accounts it is moving briskly. Its success will undoubtedly pave the way for a full-scale invasion by high-density PE of large areas in the do-it-yourself model market.—**End**

U. S. pavilion

(*From pp. 86-88*)

of caulking compound was run around the top of a column, the studs in the top of the column were pushed through the corresponding holes in the base of the canopy, and the column rapidly bolted to the canopy. At this time, also, the necessary bolt holes were drilled along the upstanding edge ribs of the canopies to permit them to be bolted to adjacent umbrellas.

With this column-canopy assembly completed, the crane lifted the umbrella into position over the footing, four dogs were bolted down to make the connection from the base flange to the anchor bolts, and at the top, the upstanding edge ribs had to be bolted to the corresponding ribs of the adjacent umbrellas.

When the umbrellas were in place for a given pavilion, a caulking bead was run along the tops of all pairs of edge ribs to provide a watertight seal. Floodlights were installed above the canopies for night-time illumination. The soft, diffused light transmitted by the thin canopy shells in the daytime was highly satisfactory for daytime illumination.

Drainage was provided by allowing rainwater to run down the hollow column and out through two slots cut in the steel pipe which provided the connection between the plastic column and the steel flange at the bottom. A circular cast concrete unit placed on top of the footing, around the base of the column, formed a small sump, and cement-asbestos pipe buried in the ground carried the water from the sump to a dry well.

To students of architecture, to construction engineers, and even to conservationists, the U. S. Pavilion in Moscow offered new ideas for protective construction. In many parts of the world erratic rainfall pattern and peculiar soil conditions make the saving of water a major problem. The lily column makes it possible to collect water automatically.

Modern Plastics is grateful to Prof. Albert G. H. Dietz for preparing the major portion of this report.—**End**

Blow molding

(From pp. 96-100)

appears to be a reasonably accurate accounting as of now. However, the editors of MODERN PLASTICS have heard rumors of other companies planning to enter the business, and there may be some overseas companies who have not yet publicized their plans. As these names become available, they will be published.

The cost for setting up a blow molding operation seems to run all over the lot and centers mostly around the blow molding machine itself. In a quick survey taken by the editors of MODERN PLASTICS, prices for blow molding equipment (including either an extruder or the injection molding machine) went as low as $12,000 and as high as over $50,000. For what it is worth as a benchmark, the majority of answers to our survey seemed to hover around the $18,000 to $25,000 category.

Most respondents to the survey agreed that air compressors are necessary. The average here ran from less than $750 for a 3 hp. compressor to between $2000 and $2300 for a 10 to 15 hp. compressor. Also agreed upon was the need for a scrap grinder to run from about $800 to $1000. Regarding other auxiliary equipment, one manufacturer lumped all equipment together (i.e., saw, drill press, flame-treating equipment for preparing PE parts for decoration, and hand tools) under an over-all figure of $2000. Other manufacturers claimed this figure was too low and pointed to the fact that a flame treating unit by itself may cost $1385. Several manufacturers also emphasized the need for a refrigerating unit or mold chiller. Since the blow molding cycle is so dependent on the length of time it takes for the material to set up in the mold, the mold chiller can reduce cycle time considerably. A typical 7½ hp. unit which can take care of three blow molding machines might sell for $2000 to $3000. But you get what you pay for, and prospective purchasers would do well to check individual companies on costs, sizes, and outputs of specific machines.

Since each blow molded appli-

Table I: Estimated costs of blow molding

Molding cost (at $8/hr.)	2.68	(at $12/hr.)	4.00
Colored PE at 33¢/lb. (Four pieces in a lb.)	8.25	(at 40¢/lb.)	10.00
Cardboard and gum tape	.35		.85
Finishing, shipping	.18		.35
Mold amortization (1½ million pieces)	.10		.10
Total for 100 pieces	11.56		15.30

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cation is in itself a special category involving its own special factors, it would be extremely difficult to pinpoint the exact production return. Of the manufacturers surveyed, the estimated cost per machine hour (including labor, overhead, rent, insurance, electricity, and other expenses, as well as capital investment, interest, and profit) ran all the way from $8 up to $25 . . . and in each case, the application was competitive and the profit worthwhile. As a benchmark, most answers to the survey centered around a $10 to $12/machine hour figure.

As far as an analysis of production return is concerned, assume two blow molding machines (of the alternating manifold type) running 48 weeks a year, five days a week, on a 3-shift operation. The two blow molded products under consideration will be a 1½ qt. bottle weighing about 110 g. and a 15 in. toy bowling pin of the same weight. The estimated cost of the four molds involved would be $1500 for the bottle and $1500 for the pin (two aluminum molds for each product at $750 apiece). Let us assume too that production speed is 5 shots/min. (this is conservative; 11 shots/min. are possible), 300 pieces/hr. (100 lb. plasticized material/hr. with a 2½ in. extruder).

In trying to arrive at the estimated costs, the editors of MODERN PLASTICS came up with a wide range of opinion. The breakdown in Table I, p. 210, covers both the low and high figures quoted.

One machine on three shifts will produce 7200 pieces per day, 36,000 pieces per week. In 48 weeks, about 1½ million bottles will be turned out on the one machine. The 15 in. bowling pin will run under the same conditions so that between the two machines, the yearly gross business at the low would average out to about $400,000, at the high to $525,000.

Another manufacturer has used a more familiar term of comparison. If you were making an 11-in. high bowling pin, injection molding figures would run along these lines: weight—100 g.; a 12-oz. machine would make four half pins to be assembled together; approximate mold cost—$8000; production—200 pins/hr.; and material cost—about 8¾¢. With blow molding, the figures would be: weight—90 g. (thinner, more even walls are possible); four complete pins would be made per cycle (same cross-section area as in the injection molded half pin); approximate mold cost—$2600 to $3000; production—450 pins/hr.; and material cost—about 7½¢. Thus you have more than twice the output at less than half the mold cost.

The savings in materials costs might be more emphatically illustrated by a case study of a toy baseball bat, 31½ in. long and 1⅝ in. in diameter. To injection mold the bat, it would be necessary to mold two halves which would incorporate matching lugs and holes (to lock the two halves together) and cross ribs in each half to support it. Part weight would be between 7½ and 8 ounces. A blow molded bat made in one piece is designed so that even with thinner walls, its tubular nature gives

it rigidity. Part weight in this case would be between 4 and 4½ oz.—a 50% materials saving.

Work is being done today with multi-cavity setups that are pushing production rates even higher. Although they cost more on some large-quantity runs, they are more than made up for by a reduction in piece price. One manufacturer has estimated that a difference of $2000 in die costs would be offset by a $1/1000 price differential on a 2½ million lot. A small item could accomplish this by an increase from 1000 per hr. to 1250 per hr. (assuming the average cost of $10/machine hr.).

The packaging markets described above and the non-packaging applications described last month (MPl, Nov. 1959, p. 83) are just the more obvious and immediate uses for blow molding.

Still to be tapped are such areas as floats, life preservers, mats, and other swimming accessories; appliance parts, e.g. blow molded ducting; industrial housings and housing components; insecticide tanks and storage tanks for agricultural uses; shades and fittings for the lighting industry—and on and on!

Still to be developed are such concepts as blow molding a thin-walled product and then filling it with foam-in-place plastics or plaster for structural strength. Refrigerator door panels and car seats could be made this way.

The possibilities are limitless: if you can blow mold a baseball bat, you can blow mold a thin, lightweight rake handle; if you can blow mold a toy wheel, you can blow mold a functional wheel for scooters, lawn mowers, golf carts, etc.; if you can blow mold a doll leg, you can blow mold a furniture leg and fill it with foam; if you can blow mold a doll, you can blow mold a mannequin or other display fixture; if you can blow mold a bottle, you can blow mold a flashlight housing. . . .

Considering the pace at which blow molding is now going, it is to be hoped that potential users will give careful considerations to its limitations as well as to its advantages before making any decisions. There is no place in a fast-moving industry of this type for unrealistic cost estimating, "get-rich-quick" schemes, or any blue-sky thinking that will promote blow molding in application areas for which it is not suitable.

Built on a sound and carefully controlled basis, it can really go places in the future.

Acknowledgments

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Roll-chilled PE

(*From pp. 109-114*)

important, and one might decide to set it aside for further investigation. (Statistical tests can be applied to determine the limits of error of such slopes, if one wants a clearer picture.)

Where more than two levels are used, a better picture of the dependence of the property on the operating factor is obtained, as in Fig. 4, p. 111, which shows the variation of haze with resin density. Here the intermediate points have been omitted and curves have been drawn for the average and extreme lower and upper points. Such a plot shows at a glance that 1) haze passes through a minimum at a density of about 0.927, and 2) that this minimum may be rather sharp or very gradual, depending on the other operating conditions. Had only two levels been used, say 0.918 and 0.933, this minimum could not possibly have been revealed, and 0.933 density would have looked best from the standpoint of minimizing haze. And because the haze would have seemed to decrease linearly as density increased, the two-level experiment would have encouraged the film-maker to try even higher densities to get even further reductions in haze. However, even with random-balance experiments, the number of runs increases rapidly with the number of levels; and two levels are better than one.

Space does not permit our discussing all of the best results obtained from these 24 runs. Several of the more significant plots are shown in Figs. 5 through 8. For those interested in examining the data more thoroughly, the complete test results are listed in Table II, p. 112. Table III, p. 114, gives a summary of conclusions reached by inspecting the 78 plots of properties versus operating factors. Because of the relatively poor precision of the slope estimates, we have simply sorted the responses into the seven classes defined in the table. Readers who wish to statistically evaluate the results of Table II may reach more quantitative (therefore, somewhat more useful) statements of the factor effects on properties.—**End**

Chemical structure

(From pp. 131-148)

tion and/or hydrolysis of numerous compounds, in ionization of acids, bases, and salts, and is a factor in many other chemical reactions (94). It is noted for its ability to dissolve more different kinds of substances than any other liquid, and it is the most abundant natural liquid.

In environmental and outdoor exposures of polymers, rain is a factor in stability of the material since it washes away soluble degradation products which might otherwise catalyze further decomposition. It may also wash away water-soluble compounding ingredients. This may be advantageous in the case of acid-producing catalysts (95). It can, on the other hand, be undesirable as in the case of thin films that contain slightly soluble light stabilizers and antioxidants.

With few exceptions plastics are very sensitive to the effects of water (96). Water may act as a plasticizer and may also be responsible for swelling of certain plastics and ultimate decomposition of others. In extremely dry environments loss of water may lead to embrittlement.

Water alone causes no permanent degradation of rubber and it must be considered along with other agents of deterioration in order to evaluate its effects (97). Moderately high humidity, in fact, may be a favorable condition for preventing deterioration of rubber (98).

The shrinkage temperature of leather at which it exhibits a definite diminution in length and width when heated in an aqueous bath, although not fully understood, may at least be partially hydrolytic deterioration. Dry leather also changes in physical dimensions when heated, but the shrinkage temperature is about 50° C. higher than when water is present (99).

Polymers that contain hydrolyzable chemical groups, such as amides, esters, acetals, nitriles, and certain ketones, and polymers in which hydrolyzable groups are formed as a result of oxidation are naturally susceptible to degradation by water (1).

If these groups are branches of the main chain, the molecular weight of the polymer is not seriously affected. When the hydrolyzable group is a link in the backbone chain, however, definite detrimental changes in strength properties may occur. Hydrolysis of these condensation-type polymers is a random chain-scission process (100):

$$-\overset{H}{\overset{|}{N}}-\overset{O}{\overset{|}{C}}-(CH_2)_x-\overset{H}{\overset{|}{N}}-\overset{O}{\overset{|}{C}}-(CH_2)_x- + H_2O \rightarrow$$

$$-\overset{H}{\overset{|}{N}}-\overset{O}{\overset{\|}{C}}-(CH_2)_x\ -NH_2 + \underset{\underset{OH}{|}}{\overset{O}{\overset{\|}{C}}}-CH_2-$$

Some branching and cross-linking may take place during acid hydrolysis (101). High temperature accelerates hydrolysis of polymers which are catalyzed by acid or alkaline conditions (1).

Outdoor exposure

In outdoor weathering it is generally not possible to separate deterioration resulting from ultraviolet radiant energy from that due to other degradative factors, including moisture, ozone, oxygen, heat, and other agents. Although it may be shown that each agent has its own degradative pattern, in actual practice the degradative processes outdoors represent influences of thermal, oxidative, and photochemical factors.

A comprehensive study of the outdoor exposure for 3 yr. of 76 samples of commercially available plastics at four selected sites has been reported (102). The properties used for the evaluation included tensile stress-strain characteristics, Rockwell hardness, dielectric constant, dissipation factor, and optical clarity (for transparent materials only). The geographic locations of the exposure sites represented these environmental extremes:

1. Picatinny Arsenal, Dover, New Jersey: temperate climate.
2. Fort Churchill, Manitoba, Canada: sub-arctic climate.
3. White Sands Proving Grounds, New Mexico: semi-desert climate.
4. Fort Sherman, Panama Canal Zone: tropical climate.

Solar radiation **(To page 220)**

was greatest at White Sands. Those materials that are most susceptible to ultra-violet light degraded most severely there: for example, cellulosics, polystyrene, cast phenolic, cast allyl resin, polyvinyl chloride, and polyvinyl chloride-acetate.

Those plastics to which cold is most damaging were most seriously deteriorated at Fort Churchill, namely, most molded phenolics and polyvinyl alcohol.

The climate in the Picatinny Arsenal area is cyclic in nature, varying from very hot during the summer to very cold during the winter. Those materials that are most susceptible to such changes deteriorated most severely there, for example, cellulosics.

All materials suffered considerable losses in Panama, as anticipated because the conditions met with in the tropics are considered to be the most severe encountered out-of-doors.

The materials were classified into four groups with respect to their resistance to outdoor weathering (Table V, p. 144). The first group embraces classes and types of materials that were degraded only slightly or not at all by 2½ to 3 years of outdoor exposure. The second embraces classes or types that satisfactorily withstood 6 to 7 months of exposure. The third includes materials that were seriously deteriorated even by brief exposure. Unfortunately, for purposes of classification not all materials of a particular class or type necessarily offer similar resistance to the weather. Certain additives and modifications in formula can have a marked influence. The fourth group contains classes and types of plastics whose weather resistance varied with the compositions of the individual materials comprising them.

A number of general observations can be made regarding the results of these exposure tests: 1) The site of exposure (climatic conditions) has a marked effect on deterioration of the plastics. 2) Addition of carbon black to polyvinyl chloride and polyethylene has a beneficial effect in the retention of strength properties during outdoor exposure. 3) Addition of ultra-violet in-

hibitors in polyamides had inconsistent effects in the different locations (more severe breakdown at White Sands and Panama). 4) Addition of antioxidants to cellulosic plastics has a marked beneficial effect in retention of strength properties at all locations except the sub-arctic.

Considerable additional information regarding the effects of outdoor weathering on plastics of various chemical types is available in the literature (103-106).

Standard laboratory tests designed to evaluate polymer stability under service conditions are generally suitable for comparative purposes, but any correlations between such test data and outdoor performance must be drawn very carefully. It seems unlikely that any one test procedure or apparatus can reproduce artificially the diverse and extreme conditions to which a polymer might be subjected in actual use (107-109). Our knowledge of degradation mechanisms and relationships between polymer structure and properties will have to be considerably expanded in order to explain the complexities of stability of polymers under the influence of several parameters simultaneously. In the meantime, all laboratory aging methods should be evaluated in terms of current knowledge and improved or altered as necessary to represent more closely a test of a fundamental factor in the aging of the polymer.

References

1. B. S. Biggs, Bell System Tech. J. 30, 1078 (1951).
2. M. C. Throdahl in A.S.T.M. Special Technical Publication 89, Symposium on Aging of Rubbers, Philadelphia, 1949 (American Society for Testing Materials), p. 35.
3. G. A. Greathouse and C. J. Wessel: Deterioration of Materials, New York, 1954 (Reinhold Publishing Corp.), p. 571.
4. R. B. Mesrobian and A. V. Tobolsky, J. Polymer Sci. 2, 463 (1947).
5. H. H. G. Jellinek: Degradation of Vinyl Polymers, New York, 1955 (Academic Press Inc.), p. 32.
6. Norman Grassie: (Chemistry of High Polymer Degradation Processes, New York, 1956 (Interscience Publishers Inc.), p. 1-23.
7. B. G. Achhammer, Analytical Chem. 24, 1925 (1952).
8. H. W. Thompson and P. Torkington, Trans. Faraday Soc. *41*, 246 (1945).
9. G. B. B. M. Sutherland and A. V. Jones, Discussions Faraday Soc. *9*, 281 (1950).
10. S. Krimm and C. Y. Liang, Bull. Am. Phys. Soc. *1*, 109 (1956).
11. B. G. Achhammer, M. J. Reiney, and F. W. Reinhart, J. Res. N.B.S. *47*, 116 (1951).
12. R. R. Stromberg, S. Straus, and B. G. Achhammer, J. Res. N.B.S. *60*, 147 (1958).
13. M. Tryon and L. A. Wall, J. Phys. Chem. 62, 697 (1958).

(To page 224)

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14. R. A. Ford, Nature *176*, 1023 (1955).

15. S. L. Madorsky and S. Straus, J. Res. N.B.S. *40*, 417 (1948).

16. L. A. Wall, J. Res. N.B.S. *41*, 315 (1948).

17. B. G. Achhammer, M. J. Reiney, L. A. Wall, and F. W. Reinhart, J. Polymer Sci. *8*, 555 (1952).

18. E. R. Adlard in "Vapor Phase Chromatography," edited by D. H. Desty and C. L. A. Harbourn, New York, 1957 (Academic Press Inc. Publishers), p. 109.

19. D. J. E. Ingram, M. C. R. Symons, and M. G. Townsend, Trans. Faraday Soc. *54*, 409 (1958).

20. H. C. Beachell and S. P. Nemphos, J. Polymer Sci. 25, 173 (1957).

21. I. Auerbach and S. D. Gehman, Analytical Chem. Vol. *26*, 685 (1954).

22. A. D. Kirshenbaum, A. G. Streng, and W. B. Dunlap, Jr., Rubber Age (N.Y.) 74, 903 (1954).

23. G. M. Kline, ed.: Analytical Chemistry of Polymers, Part I, New York, 1959 (Interscience Publishers, Inc.). Part II in preparation.

24. R. Houwink: Elastomers and Plastomers, New York, 1950 (Elsevier Publ. Co., Inc.), Vol. 1, p. 196.

25. H. Mark and A. V. Tobolsky: Physical Chemistry of High Polymeric Systems, New York, 1950 (Interscience Publishers, Inc.), p. 15.

26. L. A. Wall and R. E. Florin, J. Res. N.B.S. *60*, 451 (1958).

27. A. H. G. Jellinek, J. Polymer Sci-4, 22 (1949).

28. S. L. Madorsky and S. Straus, J. Res. N.B.S. *53*, 361 (1954).

29. S. L. Madorsky and S. Straus, J. Res. N.B.S. 55, 223 (1955).

30. S. L. Madorsky, J. Res. N.B.S. *62*, 219 (1959).

31. S. L. Madorsky and S. Straus, J. Polymer Sci. *36*, 183 (1959).

31a. S. L. Madorsky, V. E. Hart, S. Straus, and V. A. Sedlak, J. Res. N.B.S. *51*, 327 (1953).

31b. S. Straus and S. L. Madorsky, J. Res. N.B.S. 50, 165 (1953); ibid. *61*, 77 (1958).

31c. S. L. Madorsky, J. Polymer Sci. *9*, 133 (1952); ibid. *11*, 491 (1953).

31d. S. L. Madorsky, S. Straus, D. Thompson, and L. Williamson, J. Res. N.B.S. *42*, 499 (1949).

32. E. C. Baughan, M. G. Evans, and M. Polanyi, Trans. Faraday Soc. *37*, 377 (1941).

33. N. Grassie and H. W. Melville, Proc. Roy. Soc. (London) *A199*, 14-55 (1949).

34. S. L. Madorsky, unpublished work by private communication.

35. R. R. Stromberg, S. Straus, and B. G. Achhammer, J. Polymer Sci. *35*, 355 (1959).

36. D. E. Winkler, J. Polymer Sci. *35*, 3 (1959).

37. N. Grassie, Trans. Faraday Soc. *48*, 379 (1952) ibid. *49*, 835 (1953).

38. R. Simha, L. A. Wall, and P. J. Blatz, J. Polymer Sci. 5, 615. (1950).

39. Wall and Florin in ref. 26, p. 455.

40. R. A. Coleman, Modern Plastics *36*, 117. (Aug 1959).

41. Ref. 3, p. 79.

42. B. M. Duggar, ed.: "Biological Effects of Radiation," Vol. I, New York, 1936, (McGraw-Hill).

43. K. S. Campbell and P. J. Fynn, Textile Research J. *16*, 450 (1946).

44. G. F. Lothian: "Absorption Spectrophotometry," London, 1958 (Hilger and Watts Ltd.), 2nd Ed., p. 89.

45. Ref. 44, p. 91.

46. L. Bateman, J. Polymer Sci. *2*, 1 (1947).

47. M. J. Reiney, M. Tryon, and B. G. Achhammer, J. Res. N.B.S. *51* 155 (1953).

48. G. M. Kline, W. A. Crouse, and B. M. Axilrod, Modern Plastics *17*, 49 (Aug. 1940).

49. P. R. E. J. Cowley and H. W. Melville in U. S. Dept. of Commerce N.B.S. Circular 525, Polymer Degradation Mechanisms, Washington, D. C. (1953), p. 59.

50. C. W. Porter and C. Iddings, J. Am. Chem. Soc. *48*, 40 (1926).

51. Kenyon in ref. 49, p. 81.

52. Burgess in ref. 49, p. 149.

53. F. A. Bovey: "The Effects of Ionizing Radiation on Natural and Synthetic High Polymers," New York, 1958 (Interscience Publishers, Inc.).

54. G. J. Dienes, J. Applied Phys. *24*, 666 (1953).

55. M. Ference and A. J. De Restaino, Prod. Eng. *28*, 172 (Apr. 1957).

56. G. Reinsmith, A.S.T.M. Bulletin No. 232, 37 (Sept. 1958).

57. D. S. Ballantine, Modern Plastics 32, 131 (Nov. 1954).

58. Lawton, Bueche, and Balwit, Nature *172*, 76 (1953).

(To page 227)

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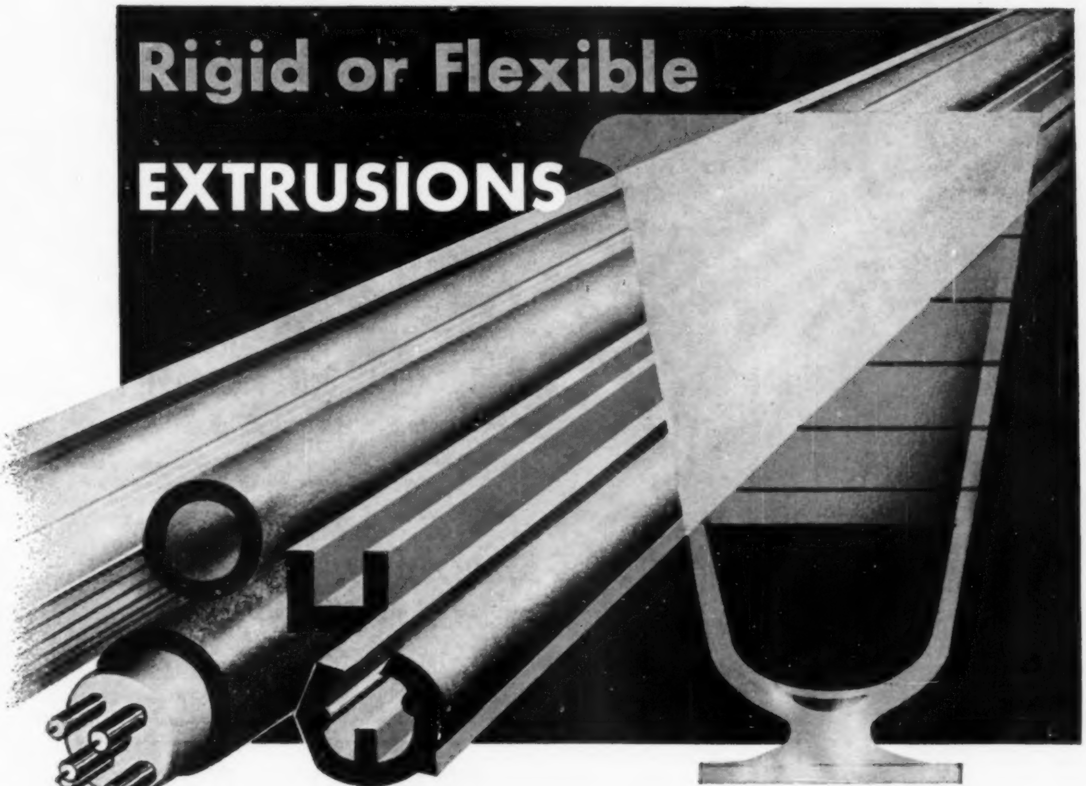

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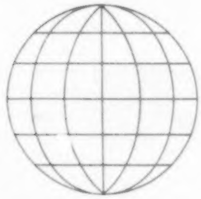

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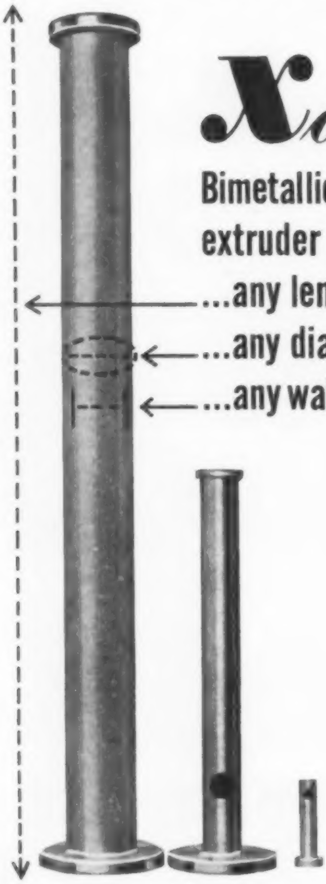

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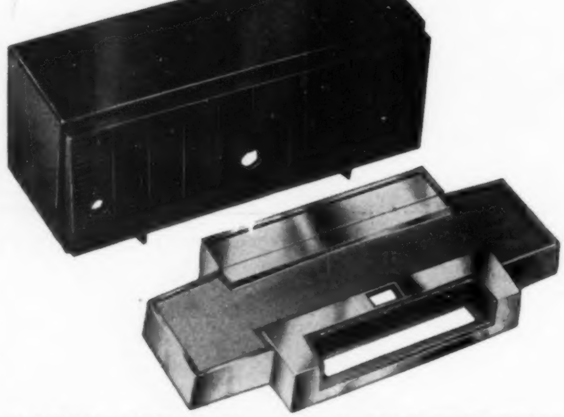

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59. A. A. Miller, E. J. Lawton, and J. S. Balwit, J. Polymer Sci. 14, 503 (1954).
60. C. D. Bopp and O. Sisman, Report 1373, Oak Ridge National Laboratory, Oak Ridge, Tenn., p. 69 (July 23, 1953).
61. R. Harrington and R. C. Giberson, Modern Plastics 36, 199 (Nov. 1958).
62. C. F. Bersch, R. R. Stromberg, and B. G. Achhammer, Modern Packaging 32, 117 (Aug. 1959).
63. V. J. Krasnansky, M. S. Parker, and B. G. Achhammer, National Bureau of Standards, D. C., unpublished work.
64. O. Sisman, Plastics Tech. 1, 345 (July 1955).
65. Saeman, Millett, and Lawton, Ind. Eng. Chem. 44, 2848 (1952).
66. H. G. Le Clair and W. H. Cobbs, Jr., Ind. Eng. Chem. 50, 323 (1958).
67. Bovey in ref. 53, p. 52.
68. Bovey in ref. 53, p. 54.
69. Bovey in ref. 53, p. 55.
70. A. Chapiro, J. Chimie Physique 52, 246 (1955).
71. P. Alexander, R. M. Black, and A. Charlesby, Proc. Roy. Soc. (London) A232, 31 (1955).
72. P. Alexander, A. Charlesby, and M. Ross, Proc. Roy. Soc. (London) A223, 392 (1954). (See Bovey in ref. 53, p. 135.)
73. L. A. Wall and D. W. Brown, J. Res. N.B.S. 57, 135 (1956).
74. Bovey in ref. 53, p. 56.
75. Reiney, Tryon, and Achhammer in ref. 47, p. 159.
76. C. S. Fuller, U. S. Patent 2,364,204 (Dec. 5, 1944).
77. W. A. Bone, J. Soc. Dyers Colourists 50, 307 (1934).
78. W. A. Bone and H. A. Turner, J. Soc. Dyers Colourists 66, 315 (1950).
79. R. Schaffer, W. A. Appel, and F. H. Forziati, J. Res. N.B.S. 54, 103 (1955).
80. E. J. Arlman, J. Polymer Sci. 12, 543, 547 (1954).
81. Bersch, Harvey, and Achhammer, J. Res. N.B.S. 60, 484 (1958).
82. D. Druesdow and C. F. Gibbs in ref. 49, p. 74; MPI 30, 123 (June 1953).
83. E. E. Schneider, Disc. Far. Soc. 19, 158 (1955).
84. Wall and Brown, in ref. 73, p. 131.
85. W. B. Ard, H. Shields, and W. Gordy, J. Chem. Phys. 23, 1727 (1955).
86. A. Charlesby and M. Ross, Nature 171, 1153 (1953).
87. G. M. Kline, R. C. Rinker, and H.F. Meindl, Proc. A.S.T.M. 41, 1246 (1941); Modern Plastics 19, 59 (Dec 1941).
88. R. B. Seymour, S.P.E. J. 10, 14 (1954).
89. Pinsky, Nielsen, and Parliman, Modern Packaging 28, 145 (1954).
90. U. S. Navy Bureau of Ships report PB 121,133: "Chemical Resistance of Plastics" (1954). Available from Office of Technical Services, Department of Commerce, Washington 25, D. C.
91. R. B. Seymour and R. H. Steiner: "Plastics for Corrosion-Resistant Applications," New York, 1955 (Reinhold Publishing Corp.).
92. Technical Data on Plastics (1957). Manufacturing Chemists' Association, Inc., Washington 6, D. C.
93. Report by Central Laboratory, Corrosion Department, Staatsmijnen in Limburg, Heerlen, The Netherlands, Chemical Resistance of Plastics (1958).
94. Greathouse and Wessel in ref. 3, p. 118.
95. Biggs, Erickson, and Fuller, Ind. Eng. Chem. 39, 1097 (1947).
96. Survey of the Properties of Plastics, Modern Plastics Encyclopedia, New York 1949 (Plastics Catalogue Corp.), p. 1134.
97. J. Crabtree and A. R. Kemp, Ind. Eng. Chem. 38, 278 (1946).
98. Greathouse and Wessel in ref. 3, p. 577.
99. Greathouse and Wessel in ref. 3, p. 515.
100. Grassie in ref. 6, p. 117.
101. Jellinek in ref. 5, p. 204.
102. R. B. Barrett. "Resistance of Plastics to Outdoor Exposure," PB 131,331 (Feb. 1955). Available from Office of Technical Services, Department of Commerce, Washington 25, D. C.
103. J. K. Long, Modern Plastics 27, 107 (Nov. 1949).
104. A. R. Burgess, Chem. and Ind. 1952, 78.
105. S. E. Yustein, R. R. Winans, and H. J. Stark, A.S.T.M. Bulletin No. 196, 29 (1954); No. 173, 31 (1951).
106. British Plastics 29, 224 (1956).
107. A. N. Bloch, American Paint J. 41, Nos. 14 and 18.
108. F. W. Reinhart, SPE News (now SPE J. 4, 3 (1948).
109. F. W. Reinhart in A.S.T.M. Special Technical Publication 236, Symposium on Some Approaches to Durability in Structures, Philadelphia, 1958 (Am. Society for Testing Materials). p. 57.—End

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THE PLASTISCOPE*

News and interpretations of the news

By R. L. Van Boskirk

Section 2 *(Section 1 starts on p. 39)*

December 1959

Blown unplasticized PVC film

An unplasticized PVC compound especially designed for the production of crystal clear film by the blow extrusion process has been announced by British Geon Ltd., London, England.

One of the chief difficulties that had to be overcome was that, unlike other thermoplastic film-forming materials, unplasticized PVC has no sharply defined melting point and does not melt at processing temperatures. This material is relatively intractable at the maximum permissible processing temperatures and thus develops high pressures (up to 7000 p.s.i.) in the extruder, compared to 3000 to 4000 p.s.i. for polyethylene. Stringent temperature control is essential and the temperature controlled zones need to be arranged so that a continuous upward gradient from feed and to die end can be obtained.

The compound used in the production of this type of film is based on a Breon dispersion polymer with added stabilizer and lubricant. The extrusion process is carried out on a high quality 1.8-in. machine in its standard form with a barrel length/diameter ratio of 15:1, and a standard film blowing head.

Seven electrically heated zones are used, each of which is accurately controlled by its own thermostat. Three of these zones are situated in the barrel, one on the flange, two on the head and one on the die. The take-off equipment is a standard unit, slightly modified for handling unplasticized PVC film.

According to British Geon, the film has excellent dimensional stability, high tensile strength, and very low water vapor permeability. It is flame resistant and possesses good light stability and ultra violet light resistance; also the cost of unplasticized PVC film is said to compare favorably with that of other thermoplastic films used for packaging. It may be heat-sealed by conventional methods and will twist readily to form a simple closure for many types of packaging.

Surface finishing is another field in which unplasticized PVC film will find many applications since it can be laminated to paper, metal, etc., to produce durable high-gloss surfaces.

Overwrap resin

The third in a series of medium-density polyethylenes designed primarily for overwrapping has been announced by Spencer Chemical Co. It is said to be more versatile than the others and is called Poly-Eth 2905.

The new resin has a density of 0.940, permitting it to be extruded into film of adequate stiffness for a wide range of overwrapping applications. In combination with its greater stiffness, the new material is said to have satisfactory heat-sealing qualities—properties heretofore difficult to combine in a polyethylene overwrapping film.

Especially recommended for chill roll casting, this resin can be made into film with a density of about 0.932. Film below this density often lacks the necessary stiffness for many overwrapping applications. It can be cast at speeds of 250 ft./minute. Extruded into blown film, it will have a density of about 0.937. The price per 1000 sq. in. 1 mil thick film is estimated at 2.25¢, compared with 2.95¢ for 300 MST cellophane and 4.5¢ for 450 MST.

Acrylonitrile and paper pulp

Acrylonitrile supplied by American Cyanamid Co. is now used in the production of paper. Through a process known as cyanoethylation, acrylonitrile is added in the pulp stage to modify the cellulosic structure. The cyanoethylated paper product forms the base of a new Permalex insulation system developed by General Electric for its line of pole-type distribution transformers.

The new paper product, which makes possible a 20% increase in peak load capability of transformer ratings with no sacrifice in life expectancy, is reported to have greater resistance to deterioration by heat and prolonged retention of dielectric and tensile strength. The paper, manufactured by Hollingsworth & Vose Co., East Walpole, Mass., is also said to have rot resistance, improved acid resistance and dimensional stability.

Nylon film

Extruded nylon film and sheet in thicknesses from 0.002 to 0.060 in., in widths up to 18 in., and any length, is being marketed by the United States Gasket Co., Camden, N. J., Plastics Div. of The Garlock Packing Co.

The new product is said to be grease, abrasion, and vapor resistant; has a low coefficient of friction; a low permeability factor; and can be steam sterilized.

The film is being used as a food wrapping and, according to the company, is suitable for mass production stamping of thrust bearings, electric insulators, oil bearing items, etc.

Formulation for extruded pipe

Cycolac LL, a resin developed specifically for extruding rigid plastic pipe, has been introduced by Marbon Chemical Div., Borg-Warner Corp. Properties claimed for the resin include improved impact strength at normal and low temperatures, combined with good long term burst strength.

Pipe made of Cycolac LL does not equal the ABS Type II Cycolac C pipe in long term fiber stress and rigidity. How- **(To page 232)**

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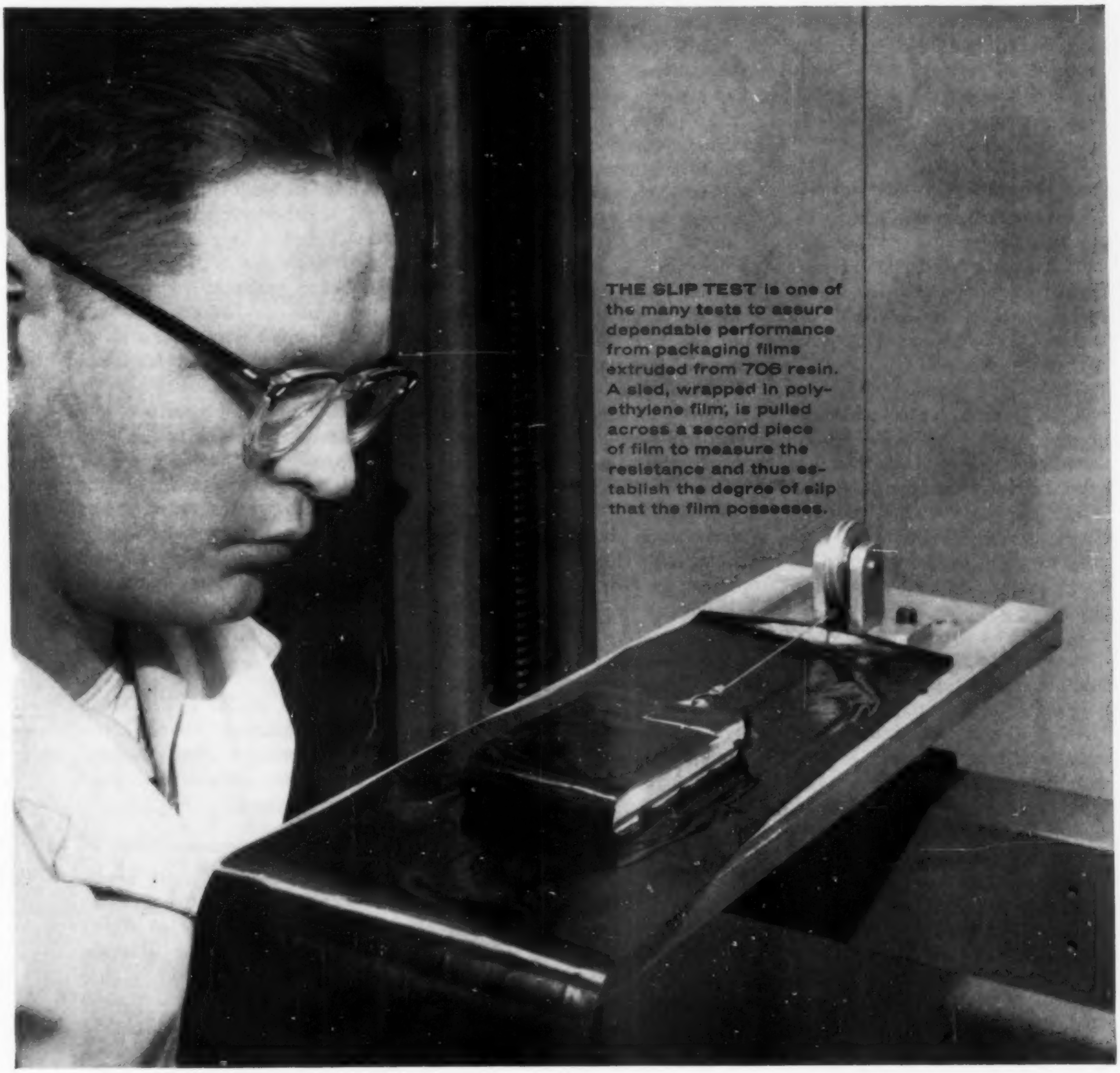

THE SLIP TEST is one of the many tests to assure dependable performance from packaging films extruded from 706 resin. A sled, wrapped in polyethylene film, is pulled across a second piece of film to measure the resistance and thus establish the degree of slip that the film possesses.

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Work with the films that "test best" in every respect. For names of extruders of 706 resins and processing data, write to Monsanto Chemical Company, Plastics Division, Room 965, Springfield 2, Massachusetts.

Monsanto

(From page 230)

ever, where superior impact, resistance to abuse or greater ductility are required, the LL material should be considered. Processing characteristics are comparable to those of the ABS Type L resins, and both Type I and Type II fittings can be used satisfactorily, the company states.

Joint operation in epoxidation

New plastics from which new industrial and consumer products can be made are the goal of a joint chemical research program set up by Archer-Daniels-Midland Co. and A. Boake, Roberts & Co. Ltd. of London, England.

Garden hose and footwear that will not crack when cold, improved plastic upholsteries, and completely new plastics that will open new markets to these materials are some of the developments expected. The joint research program will be in the field of epoxidation, which involves the chemical addition of oxygen to fatty materials used in plastics and protective coatings. It is expected that the research will unlock large new markets for soybeans.

ADM is a leading producer of fatty chemicals, including alcohols and nitrogen compounds as well as epoxidized resins and vegetable oils. A. Boake, Roberts is active in epoxidized resins and vegetable ment in western Europe and is a major manufacturer of plasticizers, perfumes, flavorings, essences, and chemical specialties.

Sprayed urethane foams

Important advances in insulation, corrosion control, and other fields are foreseen as a result of a new development in sprayed rigid polyether-based urethane foams. The new foam was developed by the Wyandotte Chemicals Corp., Wyandotte, Mich., the techniques and equipment for spray application were worked out by The DeVilbiss Co., Toledo, Ohio.

The foam is self-adhering and can reportedly be sprayed on a vertical surface without sag or runs. Heretofore, application of most rigid urethane foams has required expensive positive displacement pumps; the new development, it is stated, greatly reduces the cost of the equipment required.

Tests reported by DeVilbiss show savings in time, labor costs, and material of up to 75% in some critical installations.

The sprayed components reach the surface as a liquid and begin instant expansion, with the foam setting tack free in less than 5 minutes. Up to 7 in. of foam can be applied to a vertical surface without sag or drip. Flow is at the rate of from 3 to 5 lb. of material per min. with 10 to 20 board ft. of coverage per minute. Density is 2.5 to 3.5 lb./cu. foot. After setting, the foam surface can be finished with paint or other material.

New DOIP plasticizer

Latest addition to the list of plasticizers available from Eastman Chemical Products Inc., subsidiary of Eastman Kodak Co., is Di-(2-ethylhexyl) isophthalate (DOIP). A high quality primary plasticizer for both direct compounding and plastisol formulations, DOIP is reported to compare favorably in performance characteristics with dioctyl phthalate (DOP).

The plasticizer efficiency of DOIP in polyvinyl chloride is said to be excellent. Film comparisons with DOP plasticized material show very close agreement in most physical properties, according to Eastman, although DOIP plasticized films have a lower volatility loss on heat aging and are slightly more resistant to water extraction.

Polyethylene flame retardant

Greater heat stability and better processing qualities than other flame retardants are claimed for Aroclor 5460, a retardant produced by Monsanto Chemical Co.

Priced at 18¼¢/lb. in carload quantities, Aroclor 5460, a chlorinated terphenyl, reportedly has the combined advantages of low cost plus the economy of faster processing by improving the melt flow of the polyethylene. Polyethylene modified with Aroclor 5460 is also stated to show greater resistance to heat discoloration during injection and extrusion molding operations than is exhibited by other commercial flame retardants.

Laminated glass for buildings

Glass which becomes limp when broken instead of shattering into flying fragments has been proposed by a Monsanto engineer for windows of industrial control rooms and other structures exposed to hazards of explosions.

The glass, called laminated safety glass, is made by sandwiching a tough, resilient polyvinyl butyral film between two sheets of glass. It is the same kind of safety glass which has been used for a number of years in such uses as automobile windshields.

Photographic data from a number of tests reported by Monsanto indicates that laminated safety glass, unlike other types of safety glazing becomes limp under serious explosive conditions and folds safely from the window. This seems to occur at a pressure just below the pressure at which structural failure begins to take place thus reducing the likelihood of building collapse and subsequent human injury.

Monsanto is planning a comprehensive and detailed program to evaluate the explosion resistance of various glazing systems in cooperation with the Liberty Mutual Insurance Co. and also with government agencies.

Research foundation

A grant of $2,500,000 for the establishment of an international center for polymer chemistry at North Carolina's new Research Triangle Institute has been made by the Camille and Henry Dreyfus Foundation. The new research center, to be known as the Camille Dreyfus Laboratory, in memory of the founder and first president of Celanese Corp. of America, will have its own building, research program, staff, and facilities.

The staff will conduct basic investigations in the chemistry and physics of polymers, including cellulose, and their derivatives, with the objective of expanding the general fund of knowledge.

In addition, the Laboratory will accommodate some applied research activities. **(To page 236)**

DOW Plastiatrics
DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

DETERMINING IN-USE TOUGHNESS OF MOLDING MATERIALS REQUIRES STUDIES OF VELOCITY EFFECTS

The terms "impact resistance" and "toughness" are difficult to define, and even more difficult to measure in meaningful terms. In general, impact resistance is considered to be the ability of a material or object to withstand a shock loading, or a stress delivered at a high rate of speed. While toughness also describes a "more-or-less" degree of resistance to breaking, it does not relate to any particular speed, or range of speeds, of loading.

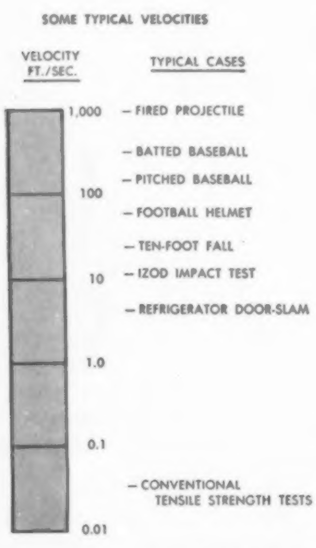
However, since the strength properties of plastics are time dependent, they will vary as the velocity, or time of stress application varies. *These variations are extremely important to the designer or plastics engineer, particularly when the in-use strength of a plastic material is critical to the successful operation of a product or mechanism.*

Some plastics are more sensitive to changes in impact velocity than others, but most have a critical velocity above which they will be brittle and below which they remain strong and ductile. Thus, in selecting a material for design purposes, it is important to know the relative resistance of the plastic to impact AT VELOCITIES OF THE SAME ORDER AS THOSE WHICH THE PLASTIC WILL BE MOST LIKELY TO ENCOUNTER UNDER USE. In-use impact velocities range from about 1 ft./sec. to many hundreds of feet per second. At left (below) are some typical impact sources and the average velocities encountered. The standard Izod impact test is made at about 11 ft./sec. and provides only screening data which is inadequate for most design purposes.

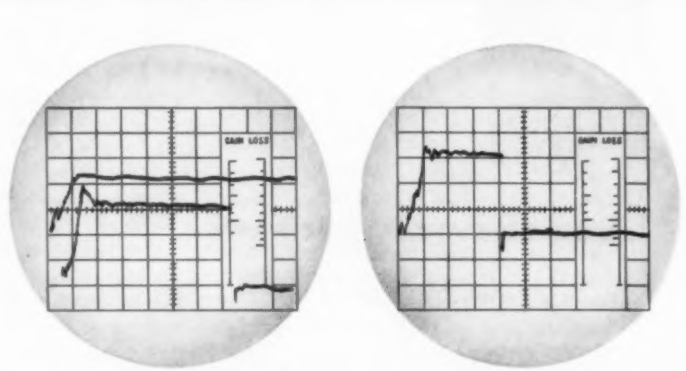
For example, data gathered during a study by Dow Plastics Technical Service Engineers on high-energy shock loadings of various molding materials indicates that resistance to breakage at low impact velocities is often considerably less than at high velocities, depending upon the particular plastic being tested. In some cases, a regular grade of plastic exhibited greater toughness at high velocities than did a so-called shock-resistant grade of the same material. In other cases, it was found that soft materials were as stiff and tough as hard materials of the same general type, under high velocity impact. A typical set of high velocity oscilloscope-recorded stress-strain data from this study is illustrated at right (below).

Further, this study illustrated the strengthening effect of geometry of the molded part, and of molecular orientation which occurs during molding. One plastic material which the Izod impact test interpreted as brittle, with little impact resistance, proved to be highly resistant to high velocity impact *when tested in its final molded form.*

These tests are part of a continuing study by Dow engineers to provide information and assistance to designers and plastics engineers in the most effective selection and use of plastics materials. Some of the results of this study are periodically reported in articles such as this, while detailed results and data are available in more complete form on request.



The range of impact velocities encountered in actual use by plastic materials, and typical impact sources which generate them.



Oscilloscope patterns of stress and strain to fracture of a typical plastic at high velocity. High velocity tests often completely reverse toughness findings which result from standard low velocity or static testing.

1959

DOW Plastiatrics

DOW'S CLINICAL APPROACH TO HEALTHY PLASTICS APPLICATION

GET THE COMPLETE SERIES OF PLASTIATRICS ARTICLES, BOUND IN CONVENIENT BOOKLET FORM!

You can now get reprints of all five articles in this current Plastiatrics series, bound in convenient booklet form. Accompanying the booklet will be supporting technical bulletins which expand on the subject matter of each article in great detail. The articles themselves provide data and technical information of interest to designers and plastics engineers in all fields.

If your work with plastics materials includes designing, engineering, specifying, or production control, we will be glad to send you a copy. Just use the coupon below, or request a copy on your company letterhead.

Following is a brief description of each of the articles contained in the booklet:

CLASSIFICATION OF DATA

Defined are five basic types of data normally employed for describing the properties of materials. The limitations and use of each type of data are described, together with examples of each.

EXPANDING DATA BASE

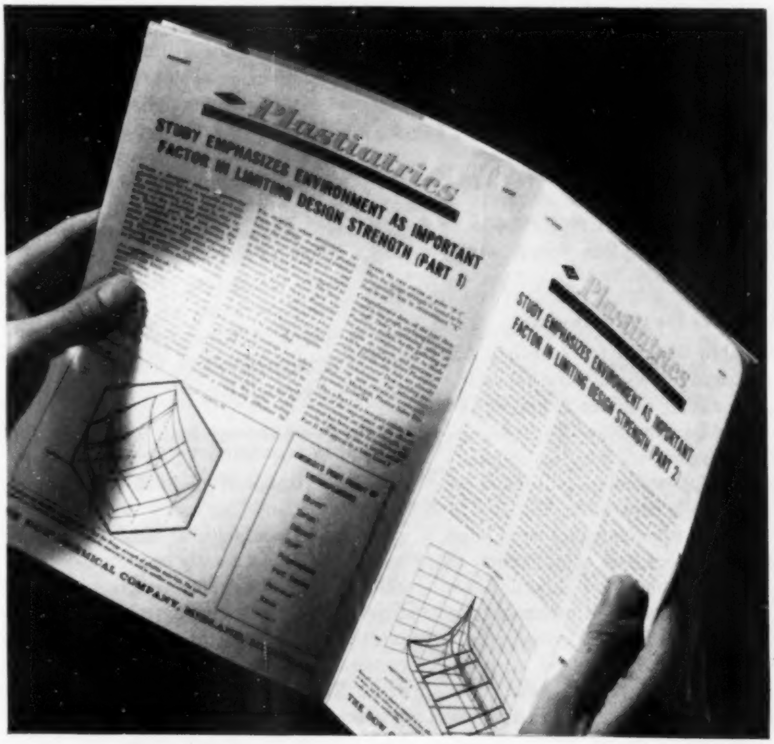
This article carries the discussion above one step further, and provides a detailed example of how quality control data must be expanded to permit screening of materials over a wider range of measurements.

THREE-DIMENSIONAL ANALYSIS

The use of three-dimensional analysis of plastics materials data is shown. The article explains the function of this method as a design tool in determining the full potential value of a plastic under consideration.

ENVIRONMENT STUDY

This two-part article describes the variable effect of environment on the working strength of plastics materials, and the necessity of testing under the environmental conditions to be encountered during actual use of the finished product.



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THE PLASTISCOPE

(From page 232)

It is anticipated that the additional staff required for such work will be supported by applied research contracts from government and industrial sources.

AviSun names sales agent

AviSun Corp., which recently began commercial production of polypropylene polymer at Port Reading, N. J., has announced the appointment of A. Schulman Inc., Akron, Ohio, as its sales agent in the plastics injection molding and extrusion industries.

The AviSun polymer will be warehouse stocked at various key points around the country, ready for quick delivery to customers by Schulman. Technical service will be supplied by plastics technologists from AviSun.

AviSun will sell through Schulman to the plastics molding industry, and will also market polymer directly to producers of monofilament, coated papers, films, etc. AviSun will shortly offer polypropylene film on a commercial basis, and early in 1960 expects to have polypropylene fiber available commercially.

Lacquer for polyethylene

Flexible lacquer for painting and decorating polyethylene sheeting and molded product is announced by Rubba Inc., New York, N. Y. The company claims that the durable, chipproof colors will not come off through uses or handling.

The new lacquer may be applied with conventional equipment to treated or untreated polyethylene, and dries in a few minutes. It is said to be as flexible as polyethylene itself, to have good abrasion resistance, and is available in a variety of transparent and opaque colors and also in white, black, and aluminum.

Light stabilized styrene sheet

A medium-high-impact light-stable styrene sheet which is reported to be capable of giving long service in lighting or indoor display and point-of-purchase applications is now being extruded by Cadillac Plastic & Chemical Co., Detroit, Mich. The new sheet may be used with fluorescent lamps with minimal hazard of yellowing, according to the producer, who also states that it has good light transmission in either clear or translucent colors, is easily formable, and is lower in cost than many other impact resistant light-transmitting materials. It is not recommended for outdoor uses.

The new light-stabilized material is available in flat or in corrugated sheets.

Sucrose acetate

Eastman Chemical Products Inc., subsidiary of Eastman Kodak Co., has announced a 4½¢/lb. reduction in the price of sucrose acetate isobutyrate (SAIB). The new price is 35½¢ per pound.

Introduced in June 1958, at a development price of 40¢/lb., this derivative of cane sugar has generated interest in the protective coatings and plastics industries. In plastics, it appears to aid in plasticization during processing.

SAIB is manufactured by esterifying sucrose with acetic and isobutyric anhydrides. Currently it is being produced in a semiworks plant at Kingsport, Tenn. by Tennessee Eastman Co., division of Eastman Kodak.

Greater economy in shipping containers

Users of standard molded polyethylene liners for steel drums now have available a new and more economical family of returnable composite shipping containers for liquids: the same standard plastic drums with an outerwrap consisting of a wirebound wooden drum. The new composite containers are stated to be substantially less expensive, lighter in weight, and more durable than the polyethylene-steel drum combination.

Inner components of the new shipping containers are standard 5-, 15-, 30-, and 55-gal. round polyethylene drums produced by Delaware Barrel and Drum Co., Wilmington, Del., with specifications unchanged from those currently used inside steel drums. The outer pack, designed by Package Research Laboratory, Rockaway, N. J., uses wood members reinforced with galvanized steel binding wires and staples. Octagonal in shape (except for the 5-gal. size, which is cubical), these outer packs are claimed to stand virtually unlimited high stacking and to be practically unbreakable under normal rough handling. All four sizes of the composite container have passed M.C.A.-I.C.C. tests for regulated liquids. Because they are classified as drums, they are entitled to the lowest freight rates on outgoing shipments and return of empties.

Compared with steel drums, cost of the wirebound outer pack averages about 50% less for all four of the standard sizes.

Catalysts for polyolefins

Two U. S. patents assigned to Aries Associates describe the use of technical grade aluminum chloride with very minor amounts of tetraphenyl tin as catalyst for high-density polyethylene and polypropylene manufacture. Such a catalyst is claimed to be simpler and cheaper than others so far proposed, non-flammable, easily removable, requiring no regeneration, and allowing tailored and directed polymerization.

According to industry talk, the process has been licensed to chemical and petroleum companies in the U. S. A., Western Europe, and Japan. One U. S. Patent, #2,900,374, of August 18, 1959 to Robert S. Aries for "aluminum halide catalysts of ethylene polymerization at low pressures" is for the catalyst only.

The other, #2,898,330 of August 4, 1959 to Hrant Isbenjian, assignor to Aries, for "novel catalyst for the polymerization of ethylene," is said to be for both the catalyst and the process.

Butadiene for surface coatings

Commercial quantities of Buton resins, which are based on butadiene polymers, will be available from a 10 million lb. plant in the second quarter of 1960, according to reports from Enjay Co. Inc., New York, N. Y. These resins, in development for several years and variously known as C-Oil and butoxy resins, have now estab-

lished uses in the formulation of industrial baked primers, baked top coats, can liners, and other surface coating applications.

Other grades of Buton resins are of interest to fabricators of reinforced plastics because of physical and electrical properties, and the economic advantage of low density. The plastic grade of the resin is being used to produce improved electrical components and is under development for airplane and missile components, decorative panels, containers, trays, ducts, tanks, and other types of fiber glass and paper laminates.

Lower cost of epichlorohydrin

A primary ingredient in epoxy resins, epichlorohydrin was recently reduced 3¢/lb. by Shell Chemical Corp. Back of the price reduction are the company's soon-to-be-completed additional glycerine facilities which will use the new acrolein-hydrogen peroxide method instead of the one employing chlorohydrins. The new glycerine facilities will make quantities of epichlorohydrin available for the development of new markets, and the price reduction is the first step toward stimulating this development.

The price reduction cuts the per-lb. price at point of delivery from 30 to 27¢ in tank cars; from 32.5 to 29.5¢ in CL lots, and from 34 to 31¢ in LCL lots.

Raw material realignment

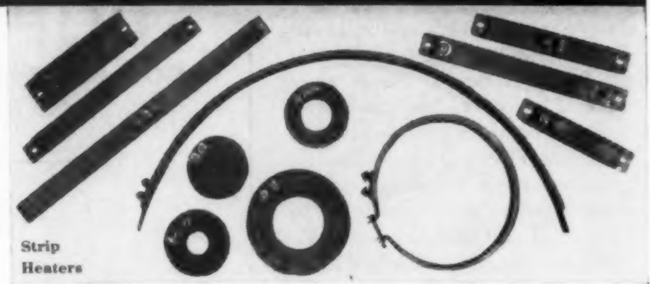
United Carbon Co. and El Paso Natural Gas Products Co. have announced the sale of United's minority interests in Odessa Butadiene Co. to El Paso. El Paso is the operator and majority holder in both firms, which are located in Odessa, Texas.

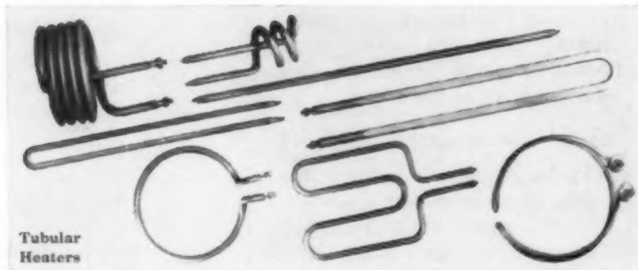
Through the acquisition, El Paso attains 100% ownership of the styrene monomer company and 75% ownership of the butadiene company. El Paso will continue to supply principal requirements of butadiene and styrene to United.

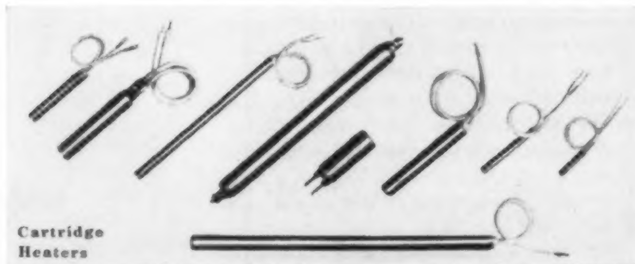
Mylar laminations

The addition of a heavy-duty adhesive backing formula for use with Mirro-Brite Mylar laminations has been announced by Coating Products Inc., Englewood, N. J. The new back- **(To page 239)**

Call your CHROMALOX Man for the heating answers







These 3 basic CHROMALOX heaters provide answers to just about any heating problem

Strip Heaters . . . that quickly and easily bolt or clamp to platens, dies, kettles, tanks, pipes, rolls, drums, ovens and air ducts. Lengths from 4 to 96 inches, widths from ¾ to 2½ inches, with cross section curving or lengthwise bending. Available with brazed-on fins.

Tubular Heaters . . . that clamp on, fit into machined grooves, cast into metals, immerse in liquids, install in ovens and ducts. Straight lengths or factory-formed to nearly any contour. Lengths from 6 inches to 30 feet. Triangular or round cross section. Available with brazed-on fins.

Cartridge Heaters . . . that smoothly fit standard drilled holes in dies, platens, molds, extrusion and injection barrels. Special leads available for protection against flexing action, abrasion, moisture or vapors. Diameters from ⅜ to 1¹⁹⁄₆₄ inches, lengths from 1⅝ to 25⅜ inches.

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Our new Catalog 60 provides detailed product information and suggests numerous applications for the complete line of Chromalox electric heaters for industry. If you have not yet received a copy, please let us know.

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THE PLASTISCOPE

(From page 237)

ing was developed for specialized applications such as bonding to wood and painted surfaces. Mirro-Brite Mylar tape rolls and die cut pieces or panels are used for decorative trim, backgrounds, and replacement of costly metal parts.

Skin packaging patent

A U. S. patent (#2,855,735) covering a widely used process for skin packaging has been acquired by Union Carbide Corp., according to R. E. Cornwell, president of Union Carbide Development Co., division of Union Carbide Corp.

Union Carbide is making rights to use its patented process available to industry through licensing agreements. Companies desiring to package articles by this process can obtain appropriate licenses under the patent either through licensed manufacturers of the prepared backing or direct from Union Carbide Corp.

Union Carbide Canada Ltd. reports that Hardman Skin-Pack Ltd. of Brentford, Ont., has been granted a license for the process in Canada.

Heavy-gage polyethylene

Production of new Ger-Pak heavy-gage seamless, wide width, polyethylene sheeting has been announced by the Gering Plastics Div. of Studebaker-Packard Corp. The sheeting is available in thicknesses up to and including 15 mils, in black and natural-clear, in 20-, 28-, and 32-ft. widths. It is shipped in gusseted rolls.

The new Ger-Pak material is applicable to service as irrigation ditch and pond liners, fumigation blankets, tarpaulins, and agricultural and industrial covers of all types.

Pioneer in plastic toys

Thirty-nine years ago Irwin Cohn founded The Irwin Corp. in Leominster, Mass., with a capital of $300. This organization with its subsidiaries, Great American Plastics and Nashua Plastics Co., is now one of the world's largest toy manufacturers and a producer of vinyl chloride resin. The company was originally a manufacturers' representative but eventually became a producer of blown celluloid and mechanical toys. Mr. Cohn claims to be among the first to produce injection and blow-molded toys, from polystyrene, acetate, and polyethylene as well as a pioneer in spray coloring and vacuum coating of toys. His company was an early producer of so-called molded "soft" vinyl dolls and toys and now claims to be marketing the largest blow-molded toys available, such as a miniature Corvette and a Rider dump truck.

New companies

Phoenix Plastics, 1423 S. 28th St., Phoenix, Ariz., is a new custom molding company organized by **Windman Brothers,** Los Angeles, Calif. The plant will involve an investment in excess of $250,000, and will include injection, compression, and transfer molding equipment, extrusion molding, vacuum forming, and styrene and polyurethane foam molding.

Diamond Plastic Industries Inc., formerly **Hake Mfg. Co.,** Roanoke, Va., has been acquired by a new Ind. corporation of the same name which will be managed and operated by the **Paper Package Co.,** Indianapolis, and whose president, **Donald B. Fobes,** will also serve as president of the new corporation. Manufacturing operations will continue to be carried out in Roanoke.

Diamond Plastic Industries Inc. is a supplier of stock plastic boxes with distribution throughout the nation.

Epoxylite of Canada Ltd., Ft. Erie, Ont., has been formed to supply specialized epoxy-resin compounds to the Canadian market. Formulations are licensed from **The Epoxylite Corp.,** El Monte, Calif. The new company replaces The Epoxylite Corp. as Canadian supplier, but **Holden Co., Ltd.** continues as exclusive distributor. Epoxylite of Canada produces compounds for the encapsulation of electrical and electronic equipment, for adhesives and sealants, and for construction coatings.

Delman-Vantines Blow Molding Corp., 133-10 32nd Ave., Flushing, N. Y., was organized **(To page 240)**

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by **The Delman Co.**, Detroit, Mich. manufacturers of automotive windshield washing equipment, and **Vantines Inc.**, New York, N. Y. plastics manufacturer, to produce molded plastics parts for the automotive and allied industries. **Chuck Bachrach**, president of Delman, is also president and a director of the new organization. Other directors are **Herbert V. Chanko, Thomas A. Tunney, Milton Podell,** and **Thomas A. Tunney Jr.**

Salem Plastics Inc., Box 276, Salem, Ohio, was formed for the production of transparent acrylic products for the aircraft and marine industries as well as fabricated parts for electrical insulation products. **Walter J. Hunston** is president.

Electronautics Corp., Maynard, Mass., was formed for the production of reinforced plastic components for missiles and aircraft. Polyester, phenolics, silicones, and epoxy resins will be the principal materials used in the company's production program. **Peter M. Reding**, formerly with Conn. Hard Rubber Co. and Raytheon Co., is president.

Plastichem Corp. 1145 E. Cass St., Tampa 1, Fla., is a new corporation which states that it has acquired all rights to a new process of molecular modification of vinyl polymers and copolymers. Coating formulations will be manufactured and sold as Plastichem organosols. **Eric Siemers** is vice-president and technical director.

Expansion

Houghton Laboratories Inc. has broken ground on an addition to its Olean, N. Y. headquarters, which will double existing space.

Ferro Corp. has launched a $2,700,000 expansion of its Fiber Glass Div. facilities in Nashville, Tenn. The company will add another glass smelting tank, fiber-producing bushings, fabricating machines, and warehouse area. The expansion program, which is expected to be completed by late 1960, will get underway as soon as the current $700,000 plant expansion is finished and will increase by 75% the company's glass-producing capacity.

Olympic Plastics Co., custom molder, has announced further expansion of its Los Angeles, Calif. facility by the acquisition of 85,000 sq. ft. of land adjacent to its present location on La Cienega Blvd. The company also plans a 40,000-sq.-ft. addition to its present plant. Construction will start immediately and production is expected during the first quarter of 1960.

Duall Plastics Inc., Athol, Mass., has increased manufacturing space and extrusion capacity by 50 percent. The company specializes in out-of-the-ordinary and difficult extrusions.

Cadillac Plastic & Chemical Co., a division of **Dayton Rubber Co.**, has purchased the plastics distribution business of **Delta Products Co.**, Fort Worth, Texas, a division of **Air Accessories Corp.** Delta was the largest plastics distributor and warehouser in the Southwest, and regional distributor for more than 20 nationally marketed lines. Manufacturing operations of Delta Products Co. were not included in the sale.

Webster Industries Inc., Salem, Mass. manufacturer of plastic film packaging and dry cleaning delivery bags, has added a warehouse site at Cartersville, Ga.

Crane Packing Co., Morton Grove, Ill., has completed its new plant devoted exclusively to the processing of Teflon, including sheet, rod, tubing and tape — and the manufacture of standard and custom proprietary items. The plant has a total manufacturing area of over 20,000 sq. ft., plus a centrally mounted 400-sq. ft. cupola for the handling of vertical extrusions.

Cary Chemicals Inc., Flemington and East Brunswick, N. J., formed **Regency Plastics Inc.** to acquire the business **(To page 242)**

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and assets of **Regency Plastics Co.,** Woodside, N. Y. This wholly-owned subsidiary of Cary is an independent finisher of vinyl film and sheeting and PE film.

This integration will provide a finishing facility for Cary's other subsidiaries, including **Great Bay Plastics & Chemical Co.,** East Brunswick, N. J., which produces vinyl sheeting from Cary Blacar resins, and will feed it to Regency for printing, embossing and laminating processes.

Cary's sales for the year ended September 1959 were approximately $7.4 million, and sales of $15 million are indicated for the fiscal year ending September 1960, the company states.

Texas-U. S. Chemical Co. (Texus) has completed plans for an expansion of its research and development facilities in Parsippany, N. J. The new laboratory will accommodate over 150 persons and will provide additional space for work largely in the polymer and petrochemical fields.

Pittsburgh Coke & Chemical Co. will construct a 20-million-lb./yr. maleic anhydride plant at the company's Neville Island, Pa. site with production expected in early 1961.

Monsanto Chemical Co. has begun construction in St. Louis, Mo., on a 50% expansion of its production capacity for bisphenol A, an intermediate used in the manufacture of epoxy, polycarbonate, and oil-soluble phenolic resins.

M & Q Plastic Products, Freehold, N. J., has expanded its facilities to four times the original square footage and installed $65,000 in new equipment for compounding, and tube, shape, film, and tape fabrications. The company specializes in nylon film.

Atlantic Engraving Corp., West Warwick, R. I., acquired **M & S Roll Engraving Co.,** East Brookfield, Mass. **Edward Megarry,** previously M & S owner, will be president of the division, which is to be located in West Warwick.

M & S manufactures embossing rolls for plastics, color, and ink.

Gilbert Manufacturing Co. Inc., Long Island City, N. Y. custom molders, has completed construction of a new wing which gives the plant a total of over 70,000 sq. ft. of production space.

Deceased

Dr. William H. Schuette, 47, a vice president of **The Dow Chemical Co.** and general manager of its Midland Division, died of a heart attack Nov. 8.

Gus G. Edelman, 76, president and founder of the **Guildcrest Corp.,** Chicago, Ill., and a pioneer in the plastics tile field, died in November.

Dr. W. S. Thompson, who will be remembered as allocations officer for vinyl resins in the WPB administration during World War

II, died suddenly of a heart attack at Atlantic City, N. J. He had been head of the chemistry department at Kent State University in Ohio since 1944.

Samuel J. Singer, 74, partner and founder of **Specialty Products Co.**, Jersey City, N. J. manufacturer of destaticizers and mold lubricants, died Nov. 4.

Alfred W. Hanmer, 55, died suddenly following an operation on Nov. 10. He had been sales manager of the **Durez Division** of **Hooker Chemical Corp.** where he had started as a sales engineer in 1929. He was a Plastics Pioneer, a director of the Society of Plastics Industry, and a member of the plastics committee of the Manufacturing Chemists' Association.

A. Hanmer

Meetings

Plastics groups

Jan. 12-15, 1960: Society of Plastics Engineers Inc. 16th Annual Technical Conference, Conrad Hilton Hotel, Chicago, Ill.

Feb. 1: The Society of the Plastics Industry Inc. (S.P.I.). Symposium on plastics in domestic refrigeration, as part of the Annual National Conference, The American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Baker Hotel, Dallas, Texas.

Feb. 2-4: S.P.I. 15th Reinforced Plastics Div. Conference, Edgewater Beach Hotel, Chicago, Ill.

Other meetings

Jan. 6-8: American Management Assn. Orientation seminar on packaging foams and expanded plastics, Hotel Astor, New York, N. Y.

Jan. 11-15: National Housewares Mfrs. Assn. 32nd National Housewares exhibit, Navy Pier and Drill Hall, Chicago, Ill.

Jan. 17-21: National Assn. of Home Builders convention-exposition, Coliseum, Conrad Hilton Hotel, and Hotel Sherman, Chicago, Ill.—**End**

COMPANIES . . . PEOPLE

Appointments, promotions, and relocations in the plastics industry.

Texas Butadiene & Chemical Corp.: W. C. Franklin, formerly asst. sales mgr., appointed mgr. of the newly organized Polychemicals Dept., which will be responsible for application research, market development, and sales of a new series of polymers, copolymers, and other types of polychemicals which the company has under development.

R. M. McFarland, formerly of Food Machinery & Chemical Corp., joined TB&C as mgr. of market development, and **J. C. French,** formerly of American Cyanamid Co., joined the market research department.

Air Reduction Chemical Co., Div. of Air Reduction Co.: C. R. Wagner promoted from staff engineer to tech. mgr. His new duties include engineering, maintenance, and laboratory operations for Air Reduction Chemical Co. and **Cumberland Chemical Corp.,** owned jointly by Air Reduction and the **Mastic Tile Corp. of America.** As tech. mgr., Mr. Wagner reports to works mgr., **O. W. Fortner.** He has been associated with Airco six years.

R. L. Siegmann named chief chemist, Calvert City, Ky. **Thaddeus A. Szymanski** transferred from Murray Hill, N. J. to the polyvinyl alcohol plant at Calvert City as plant engineer. **R. C. Burnham** named plant engineer for the vinyl acetate, alkynol, and vinyl stearate plants. **B. A. Hart** named instrument engineer.

The post of plant supt. for Cumberland Chemical Corp. was assigned to **R. F. Gasaway,** who was formerly production supt. at the Bound Brook, N. J. facility.

Monsanto Chemical Co., Plastics Div.: Responsibilities in the marketing dept. at Springfield, Mass., have been realigned. **Edmund S. Kennedy** promoted from mgr. to dir. of advertising and sales promotion. **Ralph F. Hansen,** formerly assoc. dir.—market development, is now asst. to the dir. of marketing. **Luigi A. Contini,** named mgr.—market development, with **Margaret L. Reid** as market research mgr. **Edward H. Myers** succeeds Mr. Contini as market specialist, packaging.

The industrial applications dept. has been transferred from market development to plastic products. **Thomas A. DeMarco** is mgr.

Stuart H. Rider promoted from section leader in the research dept. to asst. research dir. **Dr. Marvin Koral, John L. Grover,** and **Edward M. Varholak** joined the dept.

Theodore S. Lawton appointed an assoc. in the development dept. at Springfield. **Stanley L. Harris** named West Coast rep. at Santa Clara, Calif., to coordinate the div. program on high temperature resistant phenolic resins for the aircraft and missile industries. Also at Springfield, **Michael J. Murphy** and **Abraham A. Covo** joined the engineering dept., **Mitchell Rosenthal** the plant engineering dept., and **Robert C. Busser** the production dept.

At Texas City, Texas, **Clayton J. Bushman, Dr. Joseph D. Edwards,** and **Dr. K. Keith Okamoto** joined the research dept.

Society of Plastics Engineers Inc. elected new national officers for 1960. Shown (left to right) are:

Joseph B. Schmitt, Koppers Co. Inc., treas.; **Frank W. Reynolds, IBM Corp.,** 1st VP; **George W. Martin, Holyoke Plastics Co.,** pres.; **Haiman S. Nathan, Atlas Plastics Inc.,** 2nd VP; and **James R. Lampman, General Electric Co.,** secy.

American Cyanamid Co., Formica Corp., realigned its regional sales organization: **K. P. Pitt** continues to head the Eastern region from White Plains, N. Y. **B. R. Allen,** former North Central regional mgr., now directs the West Central region, with headquarters in Chicago, Ill. **S. J. Cartier,** former mgr. of the Southern region, becomes Western regional mgr. and moves to Los Angeles, Calif. **T. S. Diehm,** former Detroit, Mich. dist. mgr., becomes East Central regional mgr. with offices in Detroit.

H. B. Shear moves from Indianapolis, Ind. dist. mgr. to mgr. of the Detroit dist. office. **Dan R. Grigg** succeeds him in Indianapolis, moving from Louisville, Ky., and **Orville O. Retzsch,** a salesman in the St. Louis, Mo. dist., becomes Louisville dist. mgr. **David J. Murray** named New Orleans, La. dist. mgr. He succeeds **Alex R. Hill,** who now heads the Milwaukee, Wis. dist.

John L. Hagstrom named to fill the newly created office of sales mgr., molded products. He was formerly dist. mgr. in Milwaukee.

The Dow Chemical Co. formed **Saginaw Bay Div.,** which will group three separate Dow operations located in Bay City, Mich. consisting of the petrochemicals plant, producing ethylene, butadiene, and other petrochemicals; the polychemicals area, producing PE and polypropylene; and the **Bay Refining Co.,** which is supplying raw materials for the new Div. in addition to its own sales of petroleum products.

St. Regis Paper Co., Panelyte Div.: Eli Hartz, formerly mfg. mgr., now gen. mgr. for thermoplastics manufactured at the Cambridge, Ohio; Dexter, Mich.; and Richmond, Ind. plants of the company.

Alexander L. Leigh appointed gen. sales mgr. for thermoplastics and molded products. **E. E. Sanders** is mgr.—thermoplastics sales development. **V. L. Kiernan** appointed sales mgr. for major appliance thermoplastic products.

Charles L. Walters named gen. mgr. of the decorative laminating plant at Kalamazoo, Mich. **Keith V. Swonsen,** formerly mgr. — direct sales, now gen. sales mgr.—decorative laminates. He is succeeded by **William R. Sievert.**

United Plastics Distributors Assn. elected the following officers to serve during 1960: **E. E. Badgley, Transilwrap,** Chicago, Ill., pres.; **T. G. Faulkner, Faulkner Laboratories,** Tampa, Fla., VP; **Gus Metz, Commercial Plastics & Supply Corp.,** Pittsburgh, Pa., secy.

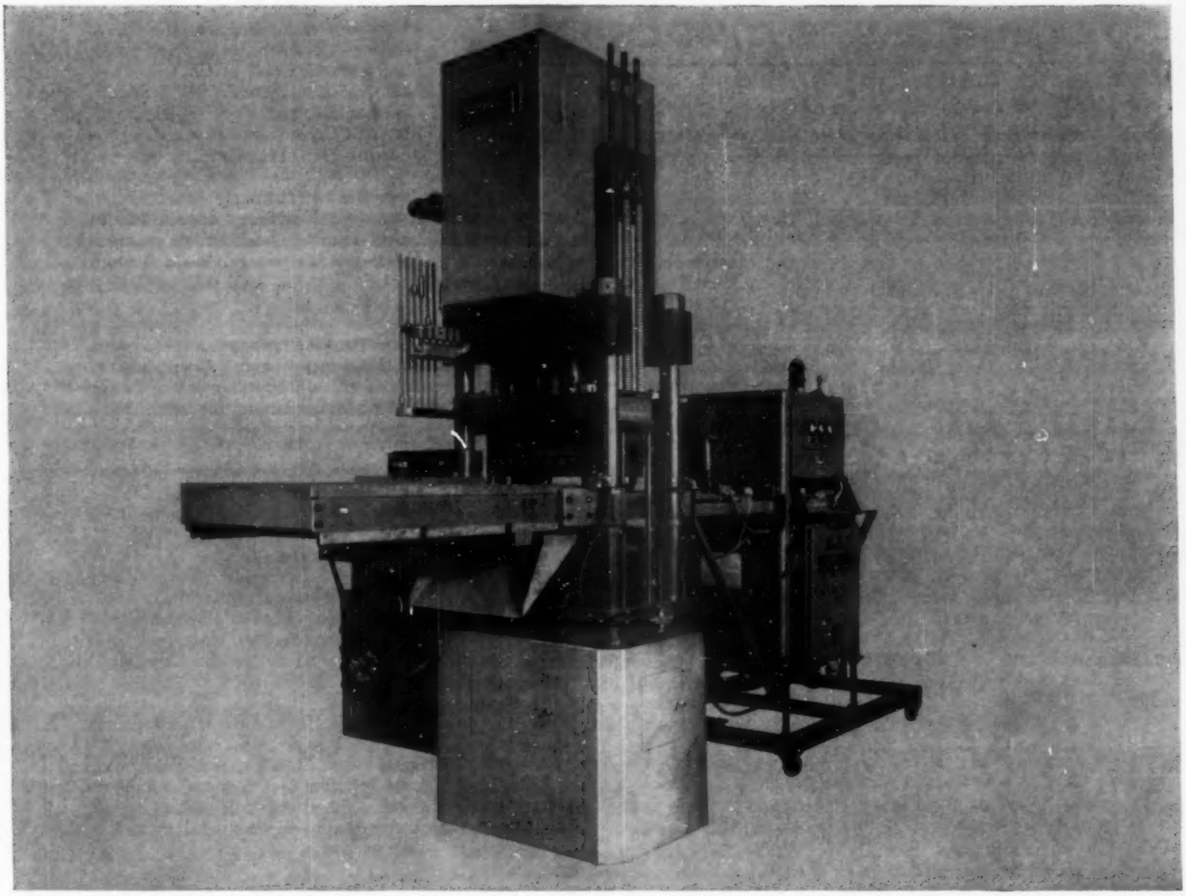
Chippewa Plastics Co., a div. of **Rexall Drug & Chemical Co.: Thomas E. Fritscher** appointed field sales mgr. He will have over-all supervision of the company's national sales operations formerly handled by **Robert F. Hrudka,** who resigned as VP—sales. **W. O. Van Doren,** formerly northwestern sales rep. for Arkell Safety Bag Co., named product sales mgr. for dairy and meat products. **William H. West,** formerly asst. dist. sales mgr. for Milprint Inc., joined the tech. sales staff. He will be responsible for applications of Chippewa's Fairlon film and sheeting and will headquarter in the Chicago, Ill. area.

Allied Chemical Corp., Plastics & Coal Chemicals Div.: Robert H. Olson named supt. of the molding compounds plant at Toledo, Ohio, which produces melamine and urea molding compounds.

National Aniline Div.: F. B. Johnson appointed asst. to the resident mgr., New York sales branch.

U. S. Rubber Co.: Harold B. Wright appointed sales mgr.—Royalite plastics, and **Charles J. Ford** is sales mgr.—Ensolite products.

American Sisalkraft Corp.: Arlo E. DuBois named plastics merchandising mgr. for PE, (To page 246)



Now from *STOKES*...NEW LINE OF COMPLETELY AUTOMATIC TRANSFER MOLDING PRESSES

Completely automatic transfer molding presses are now a reality! Stokes' new line contains features developed and proved during 25 years of automatic compression molding experience. The new presses range from 25 tons to 300 tons capacity. Already, 10 have been installed and are providing industry with new economies of operation.

Here is why these presses have gained immediate acceptance and why they can be important to you . . .

- they meet industry's need for *fully* automatic transfer molding
- their extremely fast transfer and clamping speeds
- positive ejection and discharge on both top and bottom knockout
- positive seal between feed and comb . . . parts can't fall back into mold
- complete mold protection
- automatic preform preheater and feeder integral with press
- easily modified for use as automatic compression presses

All these features—and many more—mean new efficiencies never before possible. The new line is one more example of Stokes continuing leadership in the molding equipment field.

Today is the best time to get all the facts on the new Stokes line. Write now and cash in on the built-in economies and efficiencies of the new Stokes completely automatic transfer presses.

Plastics Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

COMPANIES...PEOPLE

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vinyl, and styrene films. **Harry Clark** appointed plastics engineer. He will supervise installation and operation of new polyethylene extrusion-laminating equipment at the company's Attleboro, Mass. plant.

Americhem Inc. is the new name of **The Caldwell Co.**, Akron, Ohio, mfrs. rep. and development co.

Cary Chemicals Inc.: Philip R. Scarito appointed VP in charge of compounding and calendering at the E. Brunswick, N. J. plant. **James C. Hahn** promoted from works mgr. at Flemington, N. J. to VP in charge of the Polymer Div. He is succeeded by **Raymond T. Bohn Jr. John C. Kancylarz** appointed asst. VP, dir. of public relations and personnel.

Du Pont Film Dept.: Thomas C. Gibson, most recently group mgr. for the development of Teslar PVF film, named asst. mgr. of the market development and customer service section of the dept.

Ritter-Wilson Inc. is the new name of **Wilson Plastics of Florida Inc.** following a substantial stock interest purchase into this firm by **F. W. Ritter Sons Co.** of South Rockwood, Mich. The company was recently started as a wholly owned subsidiary of **Wilson Plastics Inc.**, 1531 Milan Rd., Sandusky, Ohio, and is equipped with high-speed, automatic molding equipment capable of turning out over 100 million plastic plant pots per year. The present management will continue and the plant is in full production. **Oran C. Wilson** is pres. and **Henry T. Ritter** is VP.

Synthane Corp., Oaks, Pa., mfr. and fabricator of industrial laminated plastics, added **Robert LeMay** and **Henry A. Fleer** to the Chicago, Ill. dist. sales staffs.

Walworth Co., New York, N. Y., concluded an exclusive licensing arrangement with **Canada Iron Foundries Ltd.**, Montreal, for the manufacture and sale in Canada of the Walworth industrial line of plastic and other valves.

Hedwin Corp., Baltimore, Md.: **E. Burley Edwards** named New York resident sales mgr., Industrial Products Dept. **Austin M. Taliaferro** appointed industrial products sales rep. for the Middle Atlantic area.

Mitchell Specialty Div. of Industrial Enterprises Inc., mfr. of **NoVo** metering and mixing systems: **Alan J. Breslau**, formerly with Thiokol Chemical Corp., named tech. dir. **Jack Dunnous** joined as dir. of systems development, process equipment dept. **Wilson B. Green** named dist. sales mgr. for Ind., Ky., and Ohio. **Emil G. Marcmann** is sales rep. for N. J. and Pa.

Taylor Fibre Co. organized an Advanced Materials Div. to investigate and develop laminated plastics and vulcanized fiber specifically for use in rockets, missiles, jet aircraft, and nuclear reactors. **Weber deVore**, formerly mgr. of the Defense Products Div. of the Heintz Div. of Kelsey Hayes Co., is dir. of the new Div.

The company opened a warehouse at 4652 W. Lawrence Ave., Chicago 30, Ill. and moved its dist. office to the new location.

Borg-Warner Corp., Marbon Chemical Div.: C. S. (Bud) Terry joined the sales service group as a molding engineer and **J. E. Gallagher** as an extrusion engineer.

Cadillac Plastic & Chemical Co. announces the opening of a new sales office at 210 S. 5th St., Minneapolis, Minn. **Thomas J. Fagin**, formerly with the Chicago, Ill. branch of Cadillac Plastic, named sales rep. in charge of the new office.

Olin Mathieson Chemical Corp. transferred its Packaging Div.'s Middle Atlantic dist. office for film operations from Harrisburg, Pa. to 1 Bala Ave., Bala-Cynwyd, Pa., on the Philadelphia city line.

Alpha Plastics Inc., Livingston, N. J., established a custom extruding dept. to produce rigid PVC shapes.

Regal Plastic Co. moved from 2800 E. 14th St. to 1725 Holmes St., Kansas City, Mo.

Whitehouse Plastic Corp. is the new name of **Whitehouse Reinforced Plastic Co.**, Ft. Worth, Texas.

Owens-Illinois Glass Co., Closure & Plastics Div.: Edward A. Coleman promoted from sales rep. to Eastern mgr.—closure sales. **E. D. MacIver Jr.** named dist. sales mgr. for the div. in the Chicago, Ill. area.

Stein Hall & Co. Inc., Stein Hall Ltd.: David McGill, former pres., became chrmn. of the board; **Roger B. Sammon**, former VP, elected pres.; and **Robert Strasser**, VP, became exec. VP.

Irwin L. Podell Inc., consultant for the plastics and chemicals industries, moved its offices and laboratory to 48 Pine St., East Paterson, N. J.

George F. Foy named to the new post of commercial development mgr. for the **Chemical Products Div.** of **Chemetron Corp.** Chicago., Ill. He will coordinate commercial development activities of the div.'s **Girdler Catalysts** unit, Louisville, Ky.; **Holland Color & Chemical Co.**, Holland, Mich.; **Dunham Chemicals**, Chicago, Ill.; and **Rock Hill Laboratory** and **Crestwood Chemicals** operation at Newport, Tenn.

J. E. Brister, formerly product gen. mgr. — polyolefins, appointed to newly-created position of coordinator-defense materials—of **Union Carbide Plastics Co., Div.** of **Union Carbide Corp.**

John Haskins appointed gen. mgr. of **Fiberform Inc.**, Oconomowoc, Wis., mfr. and supplier of melamine and phenolic laminating and specialty molding papers.

J. Turner Watson, formerly plant mgr. of the plastics div. of Dicks-Armstrong Pontius Co., appointed dir. of research of **Vinyl Corp. of America**, Dayton, Ohio.

Elmer F. Schumacher, formerly sales dir. of Du Pont's Polychemicals Dept., named special chemical and plastics consultant to the Commonwealth of Puerto Rico.

Arthur E. Bush, former owner of **Premier Plastic Mfg. Co. Inc.**, St. Louis Park, Minn., named pres. and treas. of the company, which is a custom fabricator and designer of plastic sheet material and proprietary products.

Paul Cheremisinoff appointed VP, gen. mgr. of **American Polyglas Corp.**, Carlstadt, N. J., mfr. of reinforced plastics for home, industrial, and military use.

Kenneth R. Smith appointed tech. sales rep. for **Borden Chemical Co.**, will be responsible for the company's full line of industrial and packaging adhesives. He will make his office in Greenfield, Mass.

Richard C. Dalton appointed to newly created post of prod. mgr. for molded and extruded products of **The General Tire & Rubber Co.'s Bolta Products Div.**

Walter H. Vander Weel, formerly prod. mgr., elected VP and gen. mgr. of **Brewster Enterprises Inc.**, Rochester, N. Y. suppliers of pressure-sensitive and heat-activated coatings on plastic, paper, and cloth.

Peter W. Duff appointed sales mgr. of the Industrial Fabrics Div. of **Hess, Goldsmith & Co.**, div. of **Burlington Industries.**

John W. Hawley named mgr., Product Development Dept., of **Chemtrol**, Lynwood, Calif. mfr. of plastic piping systems equipment.

Fred G. Iredale named sales mgr. of the toy div. of **Dell Distributing Inc.**, for merchandis- **(To page 248)**

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ing of Dell's new molded vinyl squeeze toys based on Walt Disney characters featured in Dell books.

Donald V. Magnuson appointed plant mgr. of **Structoglas Inc.**, Grand Junction, Tenn., a subsidiary of **International Molded Plastics Inc.**

Edward J. Babis, formerly exec. VP and gen mgr. of American Molding Powder & Chemical Corp., joined **Interplastics Corp.**, 120 E. 56th St., New York, N. Y. as VP and asst. treas. where he will report to **Gerald F. Bamberger**, pres.

Leon E. Elphee, formerly with Owens-Illinois Glass Co. and Wheaton Glass Co., joined **Moslo Machinery Co.**, Cleveland, Ohio, as mgr. of the Blow Molding Machinery Div. Mr. Elphee has been in the plastic container field since 1953, and has played a major part in the development of special machinery, tooling, and manufacturing processes for improving the quality of blow molded containers on a high volume production basis.

L. E. Elphee

David Shopkorn joined the sales staff of **Kaye-Tex Mfg. Corp.**, Yardville, N. J., mfr. of flexible vinyl film and sheeting.

J. O. Howard appointed mgr. of the **Port Reading Plant Plastics Div., Koppers Co. Inc.**, succeeding **E. A. Tenthoff** who transferred to Pittsburgh, Pa. as sr. project engineer in the Engineering Dept. of the Div.

William Pearson named sales mgr. of **Molded Fiber Glass Boat Co.**, Union City, Pa.

Richard Koshinski appointed mgr. of sales service, and sales rep. of **Norton Laboratories Inc.**, Lockport, N. Y., and its sister Co., **Auburn Plastics Inc.**, Auburn, N. Y. Both firms are custom molders.

G. J. Esselen named sales mgr. of the Industrial Chemicals Div. of **Pittsburgh Coke & Chemical Co.** which manufactures coal-derived chemicals and plasticizers for use in plastics, paint, textile industries, etc.

Dr. Robert Steckler, head of **R. Steckler Laboratories**, Cleveland, Ohio, retained as consultant to **The Polycast Corp.**, which is inaugurating a research program in the field of casting resins.

William R. Whitaker joined the sales management team of **Advance Solvents & Chemical**, New Brunswick, N. J. He was formerly Eastern sales supv. for **Carlisle Chemical Works Inc.**, Reading, Ohio, of which Advance is a div.

Erhart K. Drechsel named mgr., new product development in the **Escambia Chemical Corp.** Commercial Development Dept.

Bob Wilson, formerly sales mgr., retail products, for Techniform Inc., joined **Aeroplastics Corp.** sales.

Walter Williams appointed Eastern salesman of **Baker Bros. Inc.** line of automatic molding machines which includes automatic compression and transfer molding machines.

Malcolm J. Odell, formerly gen. mgr. of the Plastics Div. of Ludlow Papers Inc., named product development mgr., **Crocker, Burbank Papers Inc.**, Fitchburg, Mass. This appointment is the latest step in expanding the company's activities in polyethylene coated papers for which new production capacity has been added during the past few months.

Don "Buck" Lewis joined **Lester-Phoenix Inc.**, Cleveland, Ohio mfr. of die casting and injection molding machines, as sales rep.

J. George Grimm elected VP in charge of sales for **Stewart Bolling & Co. Inc.**, Cleveland, Ohio, mfr. of calenders and laminating equipment.

Philip Maslow appointed tech. dir., **Permagile Corp. of America**, Woodside, N. Y. mfr. of epoxy-based concrete repair and maintenance compounds and coatings.

John E. Beaumont appointed to the sales dept. of the **Poly Vinyl Chloride-Irvinil Div. of Great American Plastics Co.**, Fitchburg, Mass. He was formerly with Bakelite Corp. and Carlon Products Corp.

Paul C. Pearson Jr. appointed mgr. of **Celanese Plastics Co.**, Newark, N. J., div. of **Celanese Corp. of America.** He succeeds **Harry Cooper**, who retired.

Lawrence R. Klepper, formerly product mgr., named to new position of marketing mgr. for the **Construction & Farm Div. of The Kordite Corp.**, mfr. of PE film products.

Robert J. Boyden appointed sales engineer specialist of **F. J. Stokes Corp.**, Philadelphia, Pa., for its recent blow-molding machine.

Bernard Trachtman appointed sales rep. in Kansas, Okla., and Texas for **Campco Div., Chicago Molded Products Corp.**

Lincoln I. Opper named mgr. of product engineering for **The Dayton Rubber Co.'s Dayflex Plastic Hose Div.** The Dayflex Div. currently

makes vacuum cleaner hose, vent hose in a variety of diameters, and hair dryer hose.

Samuel F. Schillaci, previously VP, admin., appointed VP, marketing for **Plax Corp.**

Carl A. Bergman named to new position of chemical sales mgr.—Southern area, **General Dyestuff Co.,** div. of **General Aniline & Film Corp.**

T. M. Welton elected a dir. and VP—marketing of **Oronite Chemical Co.,** industrial chemical subsidiary of **Standard Oil Co. of Calif.**

Henry F. Weinkam named mgr. Plant I, **REF Mfg. Corp.,** Mineola, N. Y. designers and fabricators of custom RP and metal products.

Martin Safer named asst. prod. supt., **Polymer Products Div., Foster Grant Co.,** Leominster, Mass.

Prof. Herman F. Mark, Polytechnic Inst. of Brooklyn, won the 1960 William H. Nichols Medal of the **American Chemical Society's** New York Section.

Neil Anderson named regional sales mgr., Seattle, Wash. div., **Filon Plastics Corp.,** El Segundo, Calif.

Erwin W. Stegmaier, formerly with Hartig Extruders Div., Midland-Ross Corp., joined **Sterling Extruder Corp.,** Linden, N. J., in a sales and engineering capacity.

Joe Foss elected a dir. of **Raven Industries Inc.,** Sioux Falls, S. D., electronics and plastics firm.

Richard E. Wade named regional mgr. in the west for **Ren Plastics Inc.,** Lansing, Mich. formulator of epoxy resins for tools and tooling.

New reps.

Smith Chemical & Color Co. Inc., 55 John St., Brooklyn 1, N. Y., appointed by the Organic Chemicals Div. of **Olin Mathieson** as a warehousing distributor for its line of glycols, polyglycols, glycol ethers, ethanolamines, and surfactants; and by **Carey Canadian Mines Ltd.,** Quebec, Canada, for its line of asbestos fiber and shorts. . . .

. . . **The Plastics Div.** of **Seiberling Rubber Co.** named **John G. Shelley Co. of Conn.,** located in Essex, sales rep. in Conn.; and **John G. Shelley Co.,** 16 Mica Lane, Wellesley Hills, Mass., sales agent in the other New England states for its complete line of Seilon plastics . . . **Chas. W. Stone Co.,** 1914 LaSalle Ave., Minneapolis 3, Minn., appointed exclusive agent in western Wis., Minn., N. D., and S. D. by **Thoreson-McCosh Inc.,** for its line of hopper-dryers, hopper-loaders, and shear-way grinders. . . .

. . . **Plywood-Plastics Inc.,** 1950 Elmwood Ave., Buffalo, N. Y., named a distributor for **Formica Corp.,** subsidiary of **American Cyanamid Co.** . . . **Sterling Inc.,** Milwaukee, Wis. mfr. of Sterlco temperature control units for the plastic molding and die casting industries, appointed **Wolcott Machinery Co.,** 5819 Manton Ave., Woodland Hills, Calif. and **Air-Hydraulics Co. Inc.,** 2060 Happy Lane, St. Louis 25, Mo., as reps. . . .

. . . **National Automatic Tool Co. Inc.,** Richmond, Ind., appointed the following distributors for its line of 12- to 80-oz. injection molding machines: **Portland Machinery Co.,** Portland, Ore.; **Overgard Machine Tool Co.,** Denver, Colo.; **Price Equipment Co.,** Monroe, N. C.; and **Randolph G. Milnes Co.,** Willow Grove, Pa.

Corrections

Midland Die & Engraving Co. address was listed in *Modern Plastics Encyclopedia for 1960* as Belmont Ave. and Wolf Road, Franklin Park, Ill. It should have been 502 Factory Road, Addison, Ill.

"These fabulous panels . . ." (MPl, September 1959, p. 91. Caption should have read: "New idea in 'stained glass' windows is this wall in the Second Church of Christ Scientist in Syracuse, N. Y., made of the new panel."—**End**

CLASSIFIED ADVERTISEMENTS

EMPLOYMENT • BUSINESS OPPORTUNITIES • USED OR RESALE EQUIPMENT

Machinery and Equipment for sale

FOR SALE: MOLDING MACHINES: 48 os. Jackson & Church, Universal Hydraulic Compression and Injection Molder, 570 Ton cap. Mfg. 1951—Like New. 28 oz. Watson-Stillman, 1946. 12 oz. Watson-Stillman, 1940. 8 oz. Reed-Prentice, 10D8, 1940. Ferro Equip. Co., 5454 Bellevue, Detroit 11, Mich. WA 5-2230.

FOR SALE: Ovens, Grinders, Powder Mixers, Injection Molding Machine 1 oz. to 60 ozs. never used and used. Two-head Bottle Blowing Machine. Acme Machinery & Mfg. Co., Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900. 102 Grove Street, Worcester, Mass. PLeasant 7-7747. 5222 W. North Ave., Chicago, Ill. TUxedo 9-1328.

FOR SALE: 43—Baker-Perkins #17, 200 gal. jacketed mixers, sigma and duplex blades, many with individual 30 HP motors and drives, power-screw tilts. 2—Baker-Perkins 100 gal., sigma or dispersion blades, jacketed. 3—Baker-Perkins 50 gal., sigma blades, jacketed. 2—J. H. Day 35 gal. sigma blade. Perry Equipment Corp., 1429 N. 6th St., Phila. 22, Pa.

REMOVAL SALE—(MOVING TO NEWARK, N. J.) PRICES SLASHED 20 TO 50%; 1—Baker Perkins 100 gal. Sigma blade Mixer; 1—Baker Perkins size 16 TRM, 150 gal. double arm, Vacuum Mixer; 1—Rotary Cutter; 1—Kent 6" x 14" three roll mill; 6—Stokes Model DD2, DS3, and B2 Rotary Preform Presses; 4—Stokes Model "R" single punch Preform Presses. Also: Sifters, Banbury Mixers, Powder Mixes, etc., partial listing; write for details; we purchase your surplus equipment. Brill Equipment Co., 2407 Third Ave., New York 51, N. Y.

FOR SALE: 6 New Farrell Birmingham 14" x 30" two roll mills. Watson-Stillman 240 ton, ten 24" x 56" platens. Baldwin-Southwark 200 ton semi-automatic transfer molding press. 225 ton 16" record presses. French Oil 120 ton self-contained. Hydraulic pumps and accumulators. New ¾ oz. Bench Model Injection Machines. Van Dorn 1 oz. and 2 oz. Other sizes to 100 oz. Baker Perkins and Day jacketed mixers. Plastic Grinders. Seco 6" x 12" and 8" x 16" mills and calenders. New ¾" Plastic Extruder and other sizes up to 6". Stokes BB2 & RD3 Rotary Preform Tablet Machines, also single punch. Partial listing. We buy your surplus machinery. Stein Equipment Co., 107-8th St., Brooklyn 15, N.Y.

FOR SALE: 2—MPM 1½" and 2½" electrically heated plastics extruders; 1—Baldwin Southwark 150 ton self-contained compression molding press 24" x 24"; 2—Ball & Jewell granulators, 2 and 7½ HP; 2 Cumberland 7" stair step dicers, stainless steel; 4—Stokes preform presses models R, T, F and RD-3; also mixers, presses, mills, etc. Chemical & Process Machinery Corp., 52 9th St., Brooklyn 15, N. Y., HY 9-7200.

THIS MONTH'S SPECIAL! Stokes 150 Ton Compression Molding Presses, complete with timers, controls and Vickers Hydraulic Power System. Erie 26" x 84" top cap, late type, 2 roll Rubber and Plastic Mill. A-1 condition. Priced right before removal. Cumberland #1½ Rotary Scrap Chopper with 10 HP Motor Drive. Many small sizes also in stock. 1000 Ton Hydraulic Laminating Press. 10 openings with eleven 37" x 37" steam platens. Plastic Extruders, NRM 1½" and 2½"; Royle 3¼"; Hartig 3½"; Adamson 6"; Farrell 3". Injection Molding Machines, from 1 os. to 200 ozs. What Do You Need? What Do You Want? We Will Finance. Johnson Machinery Company, 683 Frelinghuysen Ave., Newark, New Jersey. BIgelow 8-2500.

MOST MODERN PACKAGING AND PROCESSING MACHINERY — AVAILABLE AT GREAT SAVINGS: Baker Perkins JNM-2, 50 gal. Stainless Steel Heavy Duty Double Arm Mixer with Hydraulic Tilt. Baker Perkins, W & P and Day Double Arm Steam Jacketed Heavy Duty Mixers—50, 75, 100, 150 and 200 gal. capacities. Day 2½ gal. MDA Mogul D.A. Vac Experimental Mixer. Fitzpatrick Models D, D-6 and K Stainless Steel Comminuters. Werner & Pfleiderer 3,000 gal. and 3,500 gal. Jacketed Double Arm Mixers. Stokes Models R, RD-1 and DD2 and Eureka Tablet Machines. Colton 2RP, 3RP, 3B, 5½ T Tablet Machines. Mikro Pulverizers, Models 1SH, 2TH, 3TH and 4TH. Day, Robinson 50 to 10,000 lbs. Dry Powder Mixers. Jacketed and Unjacketed. Package Machinery, Hayssen, Scandia, Wrap King, Campbell, Miller Wrappers. Pneumatic Scale Automatic Carton Feeder, Bottom Sealer, Wax Liner, Top Sealer with Interconnecting Conveyors. Pneumatic Scale Tite Wrap. Standard Knapp, A-B-C, Ferguson Carton Sealers. Union Standard Equipment Company, 318 Lafayette Street, New York 12, N. Y. Phone: CAnal 6-5334.

LIQUIDATION PRICES on CHOICE EQUIPMENT: Royle Extruders; Jacketed; 3¼"; 1¼"; Allen 2" Jacketed Extruder; Southwark Hydr. Presses, 36" x 36" St. Platens; 14" Ram; 2 Roll Mills, 14" x 30"; 22" x 60"; 24" x 84"; Baker Perkins Model 300 Ko-Kneaders; Baker Perkins Dbl. Arm Heavy Duty Jktd. Mixers to 300 Gal. some Vacuum Type; Pre-Form Presses by Stokes, Kux, Colton; Patterson-Kelley Stainless Twin Blender. Send for "First Facts" complete list. First Machinery Corp., 209-289 Tenth St., Bklyn. 15, N.Y.

PLASTIC VINYL CALENDERING EQUIPMENT: Strainer: One 6" x 24" with 15" top hopper. Mixer: One ribbon type, 32" x 35" x 96" with 15 HP motor, switches and station. Mills: Two 18" x 48" with 50 HP motor and accessories. One 18" x 54" with 50 HP motor and accessories. One 22" x 60" with 125 HP motor and accessories. Calenders: One 24" x 66" 3 roll vertical, motors and accessories. One 4 roll L type 16" x 36" with motors and accessories. Write for details—Box MP 1907, 125 W 41 St., NYC 36.

FOR SALE: Injection Molding Machines for release after December 1, 1959: 1950 Watson-Stillman 16 ounce; 1946 Reed-Prentice 6 ounce; 1946 Reed-Prentice 8 ounce. May be seen in operation at Franklin Plastics, Inc., Franklin, Penna.

FOR SALE: 1945-22 oz. Watson-Stillman and 1953-8 oz. Reed-Prentice with straight bore nylon cylinder. American Molded Products Co., 2727 W. Chicago Ave., Chicago, Illinois.

FOR SALE: Baldwin 8 opening steam platen press, 260 tons, plates 24" x 54", 28" stroke—complete automatic cycling. Hydraulic elevator for loading. Hydraulic system self-contained. Reply Box 6205, Modern Plastics.

FOR SALE: Fellows 8 oz. molding machine, new in 1955. Low pressure closing, Leeds & Northrup instruments. Has been well maintained and is in excellent running condition. May be seen in operation. Sterling Plastics Co., 1140 Commerce Ave., Union, New Jersey.

INJECTION MOLDING MACHINES for Immediate Sale: 2-Reed-Prentice 8 oz. 1946. 2 De Mattia 12/16 oz. 1952; 1 Reed-Prentice 4/6 oz. 1956, high speed; 1—De Mattia 4/6 oz. 1957, high speed. All in perfect working condition. Mass. area. Low price for quick sale. Reply Box 6207, Modern Plastics.

INJECTION MOLDING MACHINES: 2—Reed-Prentice 1602 machines. Good running condition. Interested in quick sale. Can be seen in operation in New York City. Reply Box 6206, Modern Plastics.

FOR SALE: (23) Potting Presses, 100 Units per hr. Cap., Bed 24" x 24". Vertical Injection Press, (with modifications, can be used as ¾ oz. injection molders) manually controlled with micro switch which sets into operation cycles for performance of potting operation. Motor drive activates agitator for flow of materials (plastic from a hopper into a heating cylinder). Mfg. 1951—Like New. Ferro Equipment Company, 5454 Bellevue, Detroit 11, Mich. WA 5-2230.

Machinery wanted

WANTED TO BUY: Used injection molding machines, oven, granulators. One machine or complete plant. Acme Machinery & Mfg. Co. Inc., 20 South Broadway, Yonkers, N.Y. YOnkers 5-0900, 102 Grove Street, Worcester, Mass. PLeasant 7-7747, 5222 West North St., Chicago, Illinois, TUxedo 9-1328.

INJECTION MOULDING MACHINES WANTED. Reed - Prentice and other makes. 4-oz., 8-oz. and larger. From users at keen prices. Reply Box 6243, Modern Plastics.

WANTED TO BUY small injection molding machine. Also small air operated press—die span of 24" x 24". Reply G. W. Hazzard, R-1 Palm Harbor, Fla.

Materials for sale

FOR SALE: 40,000 lbs. Black Repellitized Polypropylene. 29¢ per lb. Other colors also available. Reply Box 6237, Modern Plastics.

HIGHEST GRADE Correct Melt Index. Reprocessed Polyethylene Pellets, All colors by a multi-milion dollar firm, lowest prices in USA. Deluxe Plastics Co., 22821 Arlington Avenue, Dearborn 7, Michigan.

BUTTON MOLDS FOR SALE, staple and fancy patterns. Preform machines, surplus stock, etc. Export Only. Merit Plastics, Lynbrook, New York.

RIGID VINYL SCRAP, clean, uncontaminated sheets 8" x 12" x 035"; 20,000 lbs. available on skids. FOB Lawrence, Mass. Write Box 510, Lawrence, Mass.

Materials wanted

WANTED: Plastic scrap. Polyethylene, Polystyrene, Acetate, Acrylic, Butyrate, Nylon, Vinyl. George Woloch, Inc., 514 West 24th Street, New York 11, N. Y.

WANTED: All types of plastic scrap and surplus inventories such as: styrenes, butyrates; acetates, acrylics, and polyethylenes in any form. Write, Wire or Phone Collect. HUmboldt 1811. Philip Shuman & Sons. 15-33 Goethe Street, Buffalo 6, New York.

GET THE TOP MONEY FOR PLASTIC SCRAP: Now paying top prices for all thermoplastic scrap. Wanted: polystyrene, cellulose acetate, vinyl, polyethylene, butyrate, acrylic, nylon. All types and forms including rejects and obsolete molding powders. Fast action wherever you are located. WRITE, WIRE TODAY! Reply Box 6200, Modern Plastics.

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WANTED: All types plastic scrap, film, chunks, bleeder stock. Surplus inventories, polyethylene, vinyl, styrene, nylon, etc. We are a multi-million dollar company. Deluxe Plastic Co., 22821 Arlington Avenue, Dearborn 7, Michigan.

WANTED: Plastic of all kinds—virgin, reground, lumps, sheet and reject parts. Highest prices paid for Styrene, Polyethylene, Acetate, Nylon, Vinyl, etc. We can also supply virgin & reground materials at tremendous savings. Address your inquiries to: Gold-Mark Plastics Compounds, Inc., 4-05 26th Ave., Long Island City 2, N. Y. RAvenswood 1-0880.

WE ARE LOOKING for plastic building material products to distribute in the central Mid-West. If you are manufacturing or developing such a product contact Artcrest, 255 W. 79th St., Chicago 20, Illinois. HU 3-4501.

Molds wanted

WISH TO PURCHASE Houseware Molds of all types for injection molding. Please submit full information. Reply Box 6204, Modern Plastics.

STEEL MOLDS FOR INJECTION MOLDING WANTED: Suitable for stationery, giftwares, novelties, purse, bar and bar-b-que use, for 4-6 oz. molding machine. Reply Box 6208, Modern Plastics.

WANTED: Vinyl and polyethylene scrap, rejected molded parts, surplus molding powders. Sell your scrap to one of America's most progressive scrap processing plants. Alan Pastics Corporation, Canton, Mass.

Help wanted

WANTED: Manufacturer's Representative with product ideas adaptable to injection molding by midwestern injection molder desirous of establishing proprietary items. Reply Box 6203, Modern Plastics.

PERSONNEL: Executive—Technical—Sale—Production. Employers and Applicants—whatever your requirements, choose the Leader in Personnel Placement. Cadillac Associates, Inc., Clem Easly—Consultant to Plastics Industry, 29 E. Madison St., Chicago, Ill.—Wabash 2-4800. Call, write or wire—in confidence.

EXTRUSION SPECIALIST: With thorough knowledge and experience in set-up of extruded precision shapes, close tolerance tubing, for permanent position in New York with old, established custom extrusion company. We are looking for man with actual working knowledge, not administrator. Assistance will be given in relocation. Position offers chance for advancement. Reply Box 6202, Modern Plastics.

MARKET DEVELOPMENT: Opportunity to join Spencer Chemical Company's expanding Plastics Market Development program in a position which will permit the use of sales and technical abilities. We are seeking men who have a chemical or engineering background, and preferably three to five years' experience with thermo-plastics. Please send detailed resume to: W. H. Swope, Jr., Personnel Manager, Spencer Chemical Company, 610 Dwight Building, Kansas City 5, Missouri.

PRODUCTION SUPERINTENDENT WANTED. Dallas, Texas, manufacturer needs man capable of assuming complete responsibility for production in injection molding and assembly plant; must be able to gear production to quick changeover to produce a large number of items. Reply Box 6209, Modern Plastics.

WE ARE LOOKING FOR MEN who are interested in Product Development and Improvement for the New Products group working in the Research Laboratories of one of the country's largest producers of printing, converting, and technical papers, and of imaginative packaging and containers. A technical background with experience in plastics, resins, elastomers, latices, or paper is the basic requirement to fill these new positions in our expanding Research organization. Add to this imagination, creativeness, and product-mindedness, and you describe the men we are seeking. Your inquiry with full resume will receive immediate confidential attention. Write to: Hugh E. Meilinger, Technical Employment Supervisor, The Mead Corporation, Chillicothe, Ohio.

DESIGN ENGINEER for plastic extruders and accessory equipment. Graduate Engineer preferred with design experience and practical knowledge of plastic extrusion field. Must be capable of assuming responsibility for design and development of machinery in this field. Excellent opportunity for permanent position with rapidly expanding company. Please send full information on experience, education and salary requirements. Modern Plastic Machinery Corporation, 64 Lakeview Avenue, Clifton, N.J.

FILM EXTRUSION ENGINEERS: Expansion program has created openings in our Technical Department for experienced extrusion engineers. Positions cover wide range of development and process projects. Reply to Plastic Horizons, 1 Erie Street, Paterson, New Jersey.

SALES ENGINEER—PLASTICS: Chemical Division has opening for man with Chemical Engineering or Chemical degree who has experience in vinyl compounding. Headquarter in Akron. Work with customer, field sales, and company technical personnel. Excellent employee benefits. Write, giving information regarding experience and education. W. J. McLarty, The Goodyear Tire & Rubber Company, 1144 E. Market Street, Akron 16, Ohio.

FILM LAMINATION EXPERT: Wanted to set-up, run and head up a lamination department for specialty manufacturer located near Hartford, Conn., area. Applicant must be experienced in handling film laminations and be capable of administering the operation. Salary open, write in detail to Box 6210, Modern Plastics.

TEFLON SALESMEN: Wanted by firmly established, East Coast processor and fabricator of Teflon in all phases: extruded Teflon rod (60 increments), "O" rings, stand-off and feed-thru electrical terminals, molding, custom precision machined components. Company now expanding operations and sales areas, needs top-notch Teflon salesmen. Salary commensurate with background and ability. Forward resume with requirements; all areas open. Replies held in strict confidence. Reply Box 6211, Modern Plastics.

PLASTICS MANUFACTURERS REPRESENTATIVES: Currently selling users of industrial products, toys, housewares, bottles, containers. We are a leading blow molding company and would be a valuable additional line for man who represents other forms of plastic molding such as injection, compression or extrusion. Several territories open particularly West Coast and Midwest. Commissions. Reply Box 6212, Modern Plastics.

SALES AGENTS WANTED: Representatives for established foam styrene molder and fabricator, located in Mid-West. Seeking qualified custom molding sales agents. Describe area served and lines carried. Reply Box 6213, Modern Plastics.

PLASTICS ENGINEER—Graduate Engineers with degrees in Chemistry or Chemical Engineering and at least 3 years experience in one or more of the following technical areas: precision molding, re-inforced plastics, fiberglass lay-up technique, mold and equipment design. Must be able to assume over-all responsibility for evolution of process and product development from laboratory to large scale production as well as design of production facilities. Send resume to: Employment Section, ACF Industries, Incorporated, P.O. Box 1666, Albuquerque, New Mexico.

MANAGER FOR PLASTIC DEPARTMENT of Mid-West manufacturer. Not a job shop operation and man we want must be production and automation minded. Must be experienced in all phases injection molding of polyethylene and maintenance of equipment. Good opportunity for qualified man with ability to handle people. Give us complete information on yourself and qualifications. Reply Box 6214, Modern Plastics.

SALES REPRESENTATIVES WANTED: Parent corporation has openings on a national basis for established authorized manufacturers' representatives on strict commission basis in various divisional organizations. 1. Durable Formed Products, Inc. sales representatives wanted for custom vacuum-forming sales. 2. Air-O-Flow Industries, Inc. Agents wanted who specialize in sales of plastic machinery to sell automatic thermo-forming equipment. 3. Techni-Plastics, Inc. Specialized sales for custom acrylic work, edge-lite panels, dials and knobs. Indicate territory you cover. Write to: Durable Industries, Inc., Chemical Corn Exchange Bldg., 74 Varick Street, New York 13, New York.

PRE-PREG SALES: Five aggressive technical salesmen with Pre-Preg experience needed to cover western states. Knowledge of Pre-Preg uses and techniques in the reinforced plastics industry is required. Outstanding opportunity. Send complete resume to Box 6215, Modern Plastics.

SALES ENGINEER: Good knowledge of plastics machinery specifically extrusion and injection molding equipment. Sales ability by personal contact and correspondence. Good opportunity with large distributing company. Reply Box 6216, Modern Plastics.

COLOR CONCENTRATES: Are you familiar with color dispersion techniques, equipment and processes? No. 1 position is open and waiting for right man able to take this from secondary to top position in medium size New England Chemical plant. Reply directly to President, Blane Chemical Corporation, Canton, Mass.

TECHNICAL DIRECTOR: Small Northwest chemical producer supplying resin and plastic industry desires chemist with M.S. degree and at least 5 years experience, preferably in the resin industry. Mail resume to Northwest Petrochemical Corporation, Box 109, Anacortes, Washington.

PLASTIC ENGINEERS: Openings in Applications Research Laboratory in North Jersey Metropolitan area. Degree in Chemical or Mechanical engineering required; some experience in extrusion, injection molding or compression molding of plastics desirable. Positions involve laboratory applications work and customer service. Liberal company benefits. Send complete resume and salary requirements to: Personnel Department, Plastics and Coal Chemicals Division, Allied Chemical Corp., 40 Rector St., New York 6, N.Y.

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PLASTIC ENGINEER: Experienced in tool design, working knowledge of various plastics, injection and compression molding and plant operations. Permanent position open in well-established upstate New York plant. State full particulars first letter. Reply Box 6217, Modern Plastics.

ENGINEER, PLASTICS DEVELOPMENT: Location: Akron, Ohio. Prefer 5 or more years' experience in all types of plastic processing with some experience in vinyl production or development. Requires graduate chemist or chemical engineer. This permanent position has been recently created by our expansion. Full benefit program. All inquiries will be answered. For further information, write Central Personnel, The General Tire & Rubber Company, Akron 9, Ohio.

COMMISSION SALESMAN WANTED to sell polyethylene custom compounds. Territories open. Excellent opportunity with expanding concern. Reply Box 6218, Modern Plastics.

PLANT SUPERINTENDENT: Chicago corporation has an excellent position for a man with sheet extrusion and automatic vacuum forming experience. This position requires a man with extrusion background and ability to handle mechanical production problems. Modern plant. Growing company. Excellent labor. Aggressive assistants. Good salary commensurate with ability. Inquiries treated confidentially. Reply Box 6219, Modern Plastics.

RESIN CHEMIST: Immediate opening available. Experienced formulator of alkyd and polyester resins desired. Midwest location. Opportunity for growth with medium sized aggressive group. Fringe benefits. Send resume and details of personal experience. Reply Box 6240, Modern Plastics.

FOREMEN: Experienced in forming, cementing, and machining of all thermoplastic materials. Excellent opportunity for a permanent position in an aggressive, expanding company located in New York. Reply Box 6221, Modern Plastics.

WANTED — INJECTION MOLDING SUPERINTENDENT: Excellent opportunity with growth company. New York State location. Immediate opening available. Must have had molding and maintenance experience on Reid-Prentice, H-P-M or Fellows equipment. Send resume with full details. Reply Box 6223, Modern Plastics.

WANTED: Plastics engineer experienced in design development and cost analysis of plastic items. Man we are seeking must be willing to travel and be experienced in injection and compression molding techniques. Write, stating qualifications and salary expected. Reply Box 6222, Modern Plastics.

URETHANE FOAM SPECIALIST — Excellent opportunity in applications research for chemist or engineer with recent experience in the machine preparation of urethane foams. Knowledge of formulation, particularly with polyethers, and ability to evaluate foams desired. Pilot scale foam equipment will be utilized to develop customer service data. The position requires the ability to work creatively with a minimum of supervision. Please send resume, salary expected and data available to Mr. E. R. Patterson, Employment Manager, Olin Mathieson Chemical Corporation, 125 Munson Street, New Haven, Connecticut.

PLASTIC PLANT SUPERINTENDENT: Injection molding, knowledge plant scheduling, expedite working orders, etc. State qualifications in complete resume. Reply Box 6220, Modern Plastics.

MANUFACTURER'S REPRESENTATIVE: Aggressive young organization, heavy technical experience, seeks additional lines in virgin & reprocessed molding powders, related colorants & additives for the Western New York, Northeastern Penna. & Southern Ontario area. Reply Box 6238, Modern Plastics.

Situations wanted

CHEMICAL ENGINEER, 34, family, Tau Beta Pi, twelve years diversified experience; thermoplastics calendering, extrusion, and laminating; industrial coatings formulating; elastomers. Strong background in product and process development as well as in technical service, market development, sales promotion. Patents. Currently employed AAAA company in responsible position where growth opportunity is limited. Reply Box 6230, Modern Plastics.

PLANT SUPERINTENDENT—TECHNICAL DIRECTOR of large bulk Polystyrene and Polyurethane plants in South America. Extensive consultation work in final applications of these products. 10 yrs. previous experience in the States. Capable of supervising and assuming full responsibilities. Desire supervisory job in Plastics field in the United States. American citizen. Reply Box 6231, Modern Plastics.

PLANT MANAGER: Plastics Engineer, B. S. in M. E. Desires position with progressive organization. Experienced in plant operation, layout; selecting, training personnel; budgeting, planning operations; have set up successful plant operation. Background molding thermoplastics, design operation of molds, machines and assembly equipment. Detailed resume on request. Reply Box 6232, Modern Plastics.

LAMINATING-PRODUCT DEVELOPMENT ENGINEER with market research, sales and production experience. Mylar, vinyl, fabrics, adhesives, coating, embossing and printing know-how. Unusually creative with several patents granted and pending for industrial and decorative products. Seeks responsible position with growing company. Reply Box 6233, Modern Plastics.

PRODUCTION CONTROL, 37 BS, MBA, 16 years experience in injection, blow and rotational molding fields. Duties have included shop work, direction of production control, inventory control, purchasing, methods and systems analysis, cost control and estimating. Desirous of obtaining interesting position with growing and progressive organization. Reply Box 6234, Modern Plastics.

PLASTICS CONSULTANT. Polyethylene, polypropylene, vinyls, and others. Expert in molding, stabilization, blends, stress crack, mold release, crosslinking, plasticization, adhesives, printability, etc. Exhaustive foreign and domestic patent literature as well as trade and scientific publications available for searches. Ph.D., years of intensive research in these areas. Reply Box 6235, Modern Plastics.

MANAGER OR TECHNICAL DIRECTOR for Plastics Machinery Builder: Engineer with outstanding training, professional experience and record in extrusion and injection molding seeks leading position with plastics machinery builder. Goal is to guide established or new company along a sound development program toward leadership in field of polymer processing technology, and into progressive manufacturing program. Moderate financial participation possible. Reply Box 6228, Modern Plastics.

DEVELOPMENT — MARKET/PRODUCT fibers and resins background; industrial applications, non-wovens; experience in vinyl coatings, high-pressure laminates, reinforced plastics. B.S., Engineering. M.B.A., Marketing Management. Desires challenging creative position expanding present and potential markets. Young, aggressive. Reply Box 6236, Modern Plastics.

Miscellaneous

MANUFACTURERS REPRESENTATIVE: Metropolitan New York and New Jersey area—Reliable and established company, experienced in Plastic Industry wish to represent plastic machinery or component manufacturer on sales and parts. Can also offer complete existing service and repair facilities. Reply Box 6224, Modern Plastics.

ATTENTION CUSTOM MOLDERS, FOR SALE, PLASTIC MOLDS: Now is the time to diversify: Proprietary Products . . . active consumer line doing $1,000,000 nationally. New products now being tooled. No equipment to buy. Opportunity for custom molder to get into long-established line selling to chain and dept. stores, mail order, stamp and premium houses, also jobbers. Bargain at $250,000 (Cash $150,000). Less cash if properly secured. Balance long term. Reply Box 6241, Modern Plastics.

MANUFACTURERS AGENT: With unusual background in plastics and now selling rigid extrusions to the automotive industry, wishes to add another line. Company must be aggressive and financially sound. Reply Box 6225, Modern Plastics.

AVAILABLE for a West Coast open minded company. Exceptional two-man team. Administration, Sales, Production, and Engineering. Many years experience plant setup and startup in injection, compression, extrusion, including extensive experience in blowmolding. Reply Box 6226, Modern Plastics.

FINANCING FOR EXTRUSION COMPANIES: Funds available for qualified plastic extrusion companies to expand existing facilities or for new companies starting in the plastic extrusion business and needing additional money for the purchase of machinery and equipment. Reply Box 6227, Modern Plastics.

WANTED—An Investment Opportunity in a plastic manufacturing company. We are seeking a company that desires to expand its operation through the application of new capital. Also interested in acquiring interest in a firm which is fully equipped to produce tonnage, quantities of various plastics, but whose growth is handicapped by lack of capital. Please forward all details to, or contact, Box 6229, Modern Plastics, for further information.

RATES FOR CLASSIFIED ADVERTISING

All classified advertisements payable in advance of publication

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Per inch (or fraction) .. $30.00; each 3 inches or fraction (in border) $15.00 extra

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For purpose of establishing rate, figure approximately 50-55 words per inch. For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y. Modern Plastics reserves the right to accept, reject or censor classified copy.

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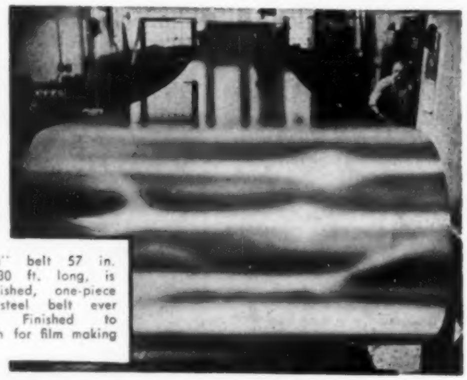

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EDITORIAL

Ten trends at the Duesseldorf Show

Now that visitors have returned and registered opinions on the Düsseldorf Show (see the show report starting on p. 153), a consensus is worthy of study. Ten major points may be made.

1. It was by far the biggest plastics show held anywhere to date. By scheduling it every three years, it is made stronger and more useful.

2. American material makers have gone international. Not so most American machinery builders. Except for a very few who secured European plant facilities and European distribution some years ago, they were conspicuous by their absence.

3. On the other hand European machinery makers, finding their equipment of interest to American plastics processors, are preparing to make, sell, and service in the United States.

4. The old comment that European machinery is slow and designed for small per-hour production is no longer valid. Their new stuff is big stuff, well engineered for automation.

5. There is a marked trend towards special equipment for single purpose, particularly in extrusion, thermoforming, casting, and blow molding.

6. From behind the Iron Curtain came delegations with fat credits. They bought, not toys, but the biggest machines available—like 500 oz. injection presses.

7. The products of European custom and proprietary processors were well designed and well made. We can no longer boast of being best and most imaginative.

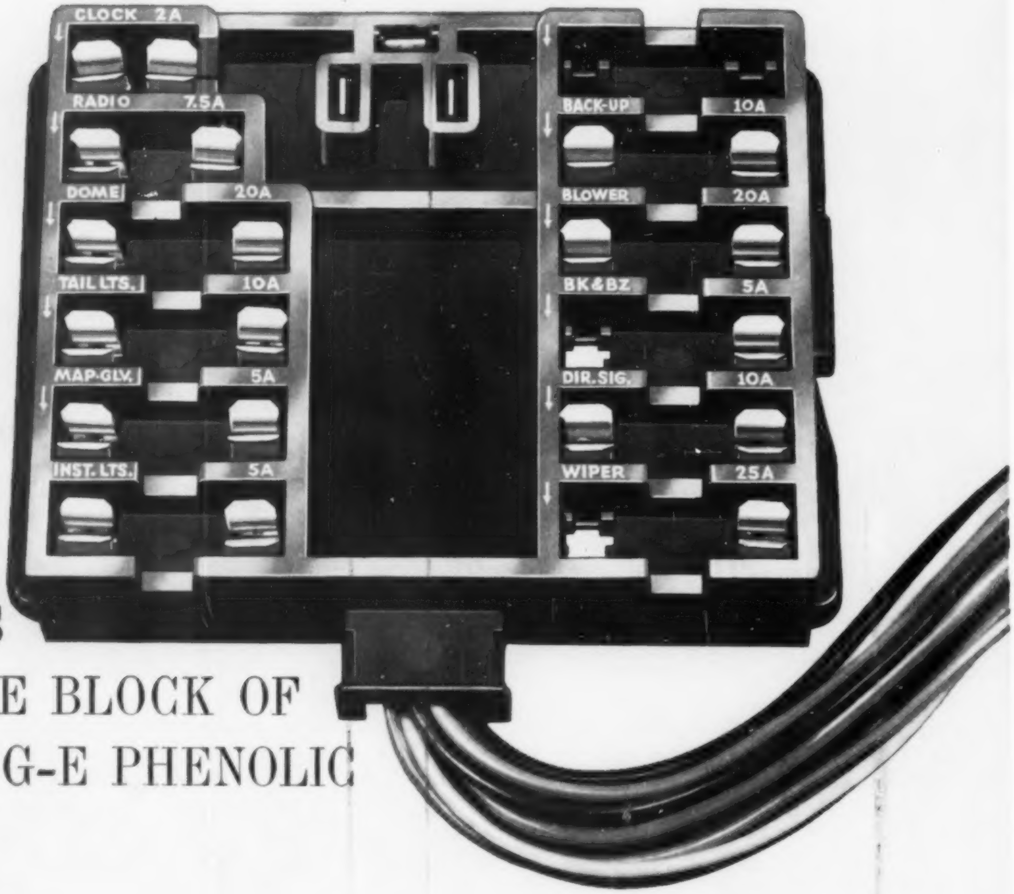
8. The advance of plastics into building construction is moving fast in Europe, led by blue-chip material makers who use plastics in their own plant construction.

9. Cross-licensing between European and American companies, particularly concerning new polymers, proceeds at a fast pace.

10. There are few shortages in either materials or machines. But in some countries labor costs are rising rapidly and the price edge is waning.

What do these trends mean? They mean that there are great opportunities in Europe for the American plastics industry, especially manufacturers of machinery and equipment. Some U. S. firms, recognizing this opportunity, have made arrangements whereby their machines are produced in Europe under license. But the vast majority, unlike American materials suppliers, have shown little interest in developing this market. The Düsseldorf Fair signaled the fact that unless they act promptly, their opportunity may be lost forever.

Modern Plastics Executive and Editorial Offices: 575 Madison Avenue, New York 22, N.Y. Tel.: PLaza 9-2710; TWX: NY 1-3063; Cable address: BRESKINPUB.



THIS FUSE BLOCK OF G-E PHENOLIC

helps protect one of America's finest cars

Fuse blocks for automobiles must be as rugged as they are intricate. That, of course, calls for a material with high impact strength and good moldability.

G-E 12906 is just such a compound. Izod impact strength of .40-.42 ft. lbs./in. of notch is significantly higher than for conventional general purpose phenolics. Fast cure speeds production. Uniform granulation and good pourability make preforming easy. And versatile *G-E 12906* can be molded by transfer, plunger, or compression techniques.

A leading supplier of automobile wiring assemblies molds the fuse block shown above from this General Electric phenolic. Interesting, too—and further proof of G-E leadership in phenolics for auto electrical system components—is the fact that in the 1960 model year almost every domestic car will be equipped with distributor caps molded of G-E compounds. And 90% of all replacement distributor caps will be made of G-E phenolics.

G-E 12906 is one of many phenolic molding compounds manufactured by General Electric. Each of these offers molders and end users special values. Investigate G-E phenolics for the tough jobs you encounter. A knowledgeable G-E sales representative, backed by experienced technical service engineers, can help you select the right one for your next project. General Electric Company, Section *MP129*, Chemical Materials Dept., Pittsfield, Mass.

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